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IMMEDIATELY after the terrific eruption of the world's largest crater, Mt. Katmai, in Alaska, a National Geographic Society expedition was sent to make observations of this remarkable phenomenon. Four expeditions have followed and the extraordinary scientific data resulting given to the world. In this vicinity an eighth wonder of the world was discovered and explored—"The Valley of Ten Thousand Smokes," a vast area of steaming, spouting fissures. As a result of The Society's discoveries this area has been created a National Monument by proclamation of the President of the United States.

AT an expense of over $50,000 The Society sent a notable series of expeditions into Peru to investigate the traces of the Inca race. Their discoveries form a large share of our knowledge of a civilization waning when Pizarro first set foot in Peru.

THE Society also had the honor of subscribing a substantial sum to the expedition of Admiral Peary, who discovered the North Pole, and contributed $55,000 to Admiral Byrd's Antarctic Expedition.

NOT long ago The Society granted $25,000, and in addition $75,000 was given by individual members to the Government when the congressional appropriation for the purpose was insufficient, and the finest of the giant sequoia trees of California were thereby saved for the American people.

THE Society's notable expeditions to New Mexico have pushed back the historic horizons of the Southwestern United States to a period nearly eight centuries before Columbus crossed the Atlantic. By dating the ruins of the vast communal dwellings in that region The Society's researches have solved secrets that have puzzled historians for three hundred years. The Society is sponsoring an ornithological survey of Venezuela.

TO further the study of solar radiation in relation to long range weather forecastings, The Society has appropriated $65,000 to enable the Smithsonian Institution to establish a station for six years on Mt. Brukkaros, in South West Africa.

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COUNTRY-HOUSE LIFE IN SWEDEN

In Castle and Cottage the Landed Gentry Gallantly Keep the Old Traditions

By Amelie Posse-Brázdová

Author of "Sardinian Sideshow" and "Roman Roundabout"

I THINK one could search all over the globe without finding anything equal to the genuine homeliness and sincerity of the Swedish country gentlefolk, such beautiful and noble traditions, or such stubborn adherence to the things and customs inherited from their ancestors.

It is not so easy to know the Swedes well, especially the dwellers in the country, who for the most part stay at home on their property. Foreigners are often led to think that they are stiff and reserved, sometimes a little sullen or even haughty. But this should be interpreted rather as a sign of their northern awkwardness and shyness. They are in reality full of fun and of warm feelings; but, when it is a question of showing the latter, their shrinking from impulsive gestures and emotional or grandiloquent language is both comic and touching.

SWEDES AS RESERVED AS THE ENGLISH

This is one aspect in which the relationship with the English is most clearly visible.

Certainly the fetters are loosened somewhat when they are in a festive mood and have drunk a little wine. But it is not then that one gets closest to them. To know and value them fully, one must observe them within their own four walls, in their daily life and activities. Only in intimacy, free from alien, disturbing elements, does their charming individuality come to full flowering. Swedish home life is a cult and a culture unlike anything else, the product of centuries of tender polishing and refining. And nowhere has it attained such perfection as in the old country houses.

Though I am a Swede by birth and was brought up in Sweden, I have lived abroad for most of the last 22 years; so that I have had ample opportunity of comparing the conditions I describe with those of other races and social classes. Last autumn and winter, after an absence of nine years, I again spent five months in my native country. I revisited many of the old places I had known, and was everywhere welcomed by relatives and friends of my childhood.

When I began to travel around from one house to another, I had at first an almost alarming impression that everything was strangely as it always had been—that life was jogging on in the same old ruts I remembered from my youth, and had to a great extent been unchanged for generations past.

But when I had looked a little more closely, I noted that even if the war had passed the Swedes by, the crisis had certainly not done so. Only the frame and certain outward forms had remained untouched.

There still were families which could maintain to some degree their former luxurious standard of living. Some had the good

Photograph by C. G. Rosenberg

FIT PLACE FOR A HAMLET'S BROODINGS IS GRIM MARSVINSHOLM

Due to insidious fevers from the stagnant waters of the lake or to the tragic fates which for three generations pursued the family that owned the castle until 1912, folklore says ghosts walk there. The author, in her childhood and youth, experienced the oppressive atmosphere that enfolds the brick walls and copper-capped towers built on piles in the lake.

Photograph from Amelie Posse-Brázdova

KING GUSTAF V (LEFT) OFF FOR A SHOOT AT SKABERSJÖ, SKÅNE

Third from the left is Count Stig Thott, whose family have been masters of the castle since 1600. Baron Carl Gotthard Bonde, of Eriksberg Castle, a friend of the King and brother-in-law of the Count, walks at the extreme right (see text, page 44, and illustration, page 15).

fortune, or the prudence, not to invest their fortunes in the securities which had later been affected by the crisis and the Kreuger crash. Others had all their land leased on old and profitable contracts, so long as the tenants could keep up their payments. But these were comparatively few and privileged exceptions.

FARM PROBLEM ACUTE IN SWEDEN

If the situation is serious for nearly every one nowadays, it is often catastrophic for the great landowners and territorial magnates. Not a month passes but some of them have to leave home and property.

And where they stick to their old estates despite all their difficulties, they often do so less for their own sake, but more in order not to abandon their retainers to unemployment. In the case of entailed estates there are of course no bankruptcies and forced sales, but it is not much more pleasant to be placed under the management of banks and creditors.

For Swedish agriculture can no longer pay its way. There is the same conflict between agriculture and industry as in most other countries; and it looks as if the former were getting the worst of it.

A series of relief schemes has been started to try to aid agriculture in Sweden, as elsewhere. But there has been no visible result thus far. An intensive educational campaign has been set on foot; state advisers and controllers have been provided for every branch of forestry and agriculture.

There are such things as the milk dues, which are intended to make up the difference in price of the butter which is sold at home and that which is exported at unduly cheap rates. It is hoped by such measures to keep the price of the former somewhat above production costs. Such is also the aim of the new milling laws, according to which no mill may grind foreign grain without mixing with it a high percentage of native grain.

An active agitation is carried on for "buying Swedish" and for burning Swedish wood in the heating apparatus of public institutions to reduce the importation of coal.

To me the Castle of Läckö, on an island in Lake Vänern, is the essence of Sweden's ancient grandeur (see pages 6–9).

Photograph by G. Heurlin

DAUGHTERS OF DALARNA POSE BESIDE THE BIRCHES

In some Swedish provinces caps and dresses not only provide a gazetteer of the parishes to which the women belong, but frequently indicate whether they are married or not (see Color Plate III). White caps are worn if they are married; if not, red is the requisite color.

It was there I obtained the first decisive impress of its spirit. Many of the most delightful memories of my childhood and girlhood are of Läckö—not because my father's mother was a scion of Magnus Gabriel de la Gardie (the mightiest noble of Sweden's "grand siècle," who had rebuilt it to make a worthy home for his wife, a princess of the royal blood), but because Läckö was bestowed in 1808 on a general who served in the war against Russia. And the last of his descendants was my grand-uncle.

He lived on the pleasant old "King's farm," a short way from the castle. The castle itself was at that time quite uninhabitable and in very bad repair. But its gloomy dungeons and secret passages, its 250 rooms and halls, were the most marvelous, thrilling resort for a band of adventurous, imaginative cousins.

When a little older, we were most fascinated by the room in which Magnus Gabriel's mother had lived—the beautiful Ebba Brahe, celebrated in legend, who was the beloved of Gustavus Adolphus' youth.

Or we would clamber over the walls into the romantic, neglected little castle garden; that was the most splendid place for solitary dreams and meditations on the future and on days long past. The castle now belongs to the State and has recently been restored.

GREAT HOUSES WERE ONCE FORTS

Most of the medieval castles in Sweden are, like Läckö, situated on heights surrounded by water or in otherwise inaccessible places. Such placement, needless to say, was not due to any considerations for natural beauty, but because it afforded the most advantageous defense.

For these strong stone houses had developed direct from the prehistoric fortifications whose foundations are still found here and there.

When Sweden, in the 16th century, ceased to be disturbed by civil war, the gloomy and inhospitable fortresses were gradually converted into dwelling houses. As time passed these grew more and more comfortable, and esthetic considerations became more decisive. Many of our most beautiful castles date from this interesting transition period. From the beginning of the 17th

Drawn by Newman Bumstead

HISTORIC COUNTRY ESTATES DOT THE MAP OF SWEDEN

Most of the magnificent castles and manor houses are concentrated in Skåne, to the south, and in the central provinces which border lovely Lake Mälaren. Within the ancient walls of these fine homes owners and their families live in the cultured and aristocratic atmosphere of long ago.

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"THE CASTLE OF LÄCKÖ, ON AN ISLAND IN LAKE VÄNERN, IS THE ESSENCE OF SWEDEN'S ANCIENT GRANDEUR"

Formerly a medieval fortress, it was converted into a stately château by Count Magnus Gabriel de la Gardie, brother-in-law of King Charles X. During the author's youth the place was uninhabitable, but its 250 rooms, halls, and gloomy dungeons were thrilling play resorts for her and her imaginative cousins (see text, page 3). The place now belongs to the State and has recently been restored.

Photograph by C. G. Rosenberg

ONCE THE ARMOR AND GUN CARRIAGES OF LÄCKÖ'S CEILING GAZED DOWN UPON HEROIC BATTLE SCENES

The elaborate paintings which formerly adorned the bare walls of this Hall of Knights have been transferred to the Military School at Karlsborg. Beneath the gorgeous ceiling and wall decorations, which Magnus Gabriel de la Gardie had executed in wood by the German masters Werner and Hammer, are old frescoes.

Photograph by C. G. Rosenberg

LÄCKÖ'S EMPTY COURTYARD FORMERLY ECHOED WITH RATTLING ARMS

Like nearly all of the castles in Sweden, this place was first built as a fortress, and was converted to a dwelling after the country ceased to be rocked by civil wars. It is surpassed in size only by the Royal Palace in Stockholm.

century Sweden was a great power, and remained one till Charles XII's unlucky campaigns impoverished the country and put an end to its domination in the Baltic.

Among the medieval Swedish castles touching the early Renaissance style, Skarhult, Vittskövle, and Torup are the most characteristic and best preserved. They are in Skåne, and were rebuilt in the 16th century (see Color Plates I, IV, and V).

MOATS OF OLDEN TIMES

Vittskövle (page 17) and Torup are laid out on a similar plan, with four wings round a courtyard, towers at diagonally opposite corners, stepped gables and firing passages; and both were surrounded for defense purposes by moats, over which drawbridges were lowered in olden times.

At Torup these moats have been filled since the 18th century along two of the façades, and replaced by gardens laid out in the old style with sculptures, rose pergolas, and box hedges. But the charmingly weathered brick walls are still reflected in quiet waters, among waterlilies and proud swans.

The courtyard at Torup, with its Gothic cloister and pointed arches, is one of the most remarkable in our country from the standpoint of art and history. A stone tablet is set into the wall over its gateway. Its

Photograph by G. Heurlin

THE "SUNDAY BEST" OF RÄTTVIK AFFORDS A PAGEANT OF HISTORY

The author found that at her aunt's house custom decreed the wearing of sober garments when the family went on an errand of piety (see text, page 26).

Photograph by Knud Sorensen

THIS CHAPEL WAS NONE TOO LARGE FOR OCCUPANTS OF LÄCKÖ AND THEIR RETINUE

"Kingdoms in miniature" were the large country estates of Sweden. With private chapels, tenants' dwellings, fowl runs, dairies, looms, and gardens, they were sufficient unto themselves. Now the old order is passing.

Latin inscription is dated 1632 and was composed by the owner of the property at that time, Sigvard Grubbe, a scholar and a friend of the King. He calls upon his successors, "whoever they may be," to do all in their power, as he did, to preserve and beautify the ancient building they have inherited.

TORUP THE MECCA OF CELEBRITIES

Probably none of them has been better equipped to carry out this injunction than its present owner, Baroness Henriette Coyet. On terms of close friendship with most of the members of the Royal Family, she loves to surround herself with eminent personalities in various branches of art and science, and she is a comprehending friend to them (see illustration, page 12).

Nobel prize-winners and other foreign celebrities are received at Torup when they visit Sweden. The Swedes in general, the people of Skåne in particular, have felt themselves secure in the knowledge that no one could represent them more worthily than this lively, highly cultured lady.

Of course, so energetic a person does not content herself merely with social life and the management of her great house. Her keenness for the promotion of local home industry and the preservation of local treasures has benefited the whole province. The same may be said of her experience and taste in all that concerns gardening and the cultivation of flowers. The extensive park of Torup, surrounded by luxuriant beech woods, the different beds, with old-fashioned roseries and herb gardens, are favorite goals of specialists and laymen for purposes of study.

There all kinds of herbs, and medicinal plants, now as good as forgotten, are still to be found. She takes a pride in continually increasing the collection. When Howard Carter was at Torup she inquired whether he had discovered any protecting herbs in Tutankhamen's coffin. He replied that he had, and that among them he had found the root of an alruna—the only time he had seen this legendary, mysterious plant. And then his hostess had the satisfaction of being able to show him a specimen in full and luxuriant growth in her own herb garden.

Since my mother was a relative and intimate friend of the mistress of Torup, I had in my teens spent most of my holidays at that delightful spot; but when I went back last autumn half a lifetime had passed since I had last been there. It was, too, the first day of my stay in Sweden after nine years of absence, and in the drizzly September rain everything seemed to me as dreamlike, romantic, and unreal as a scene from some Maeterlinck drama.

To complete the illusion, the fairy prince of my youth was there, too, the painter who is the King's brother. He has produced many of his best landscapes just at that place, and some are included in the Torup gallery.

In the ancient guardroom, where in old times the garrison of the castle sat by the loopholes and guarded the drawbridge, there now hangs a remarkably fine collection of modern paintings. They sparkle and blossom on the whitewashed walls, and bear eloquent witness to the new times in which the chatelaine takes such a keen and vital interest. She has not only collected, preserved, and faithfully restored all the old possessions which have fallen into her hands, but she has also wished to give a place to new ones which in art express our time and its fermenting youth.

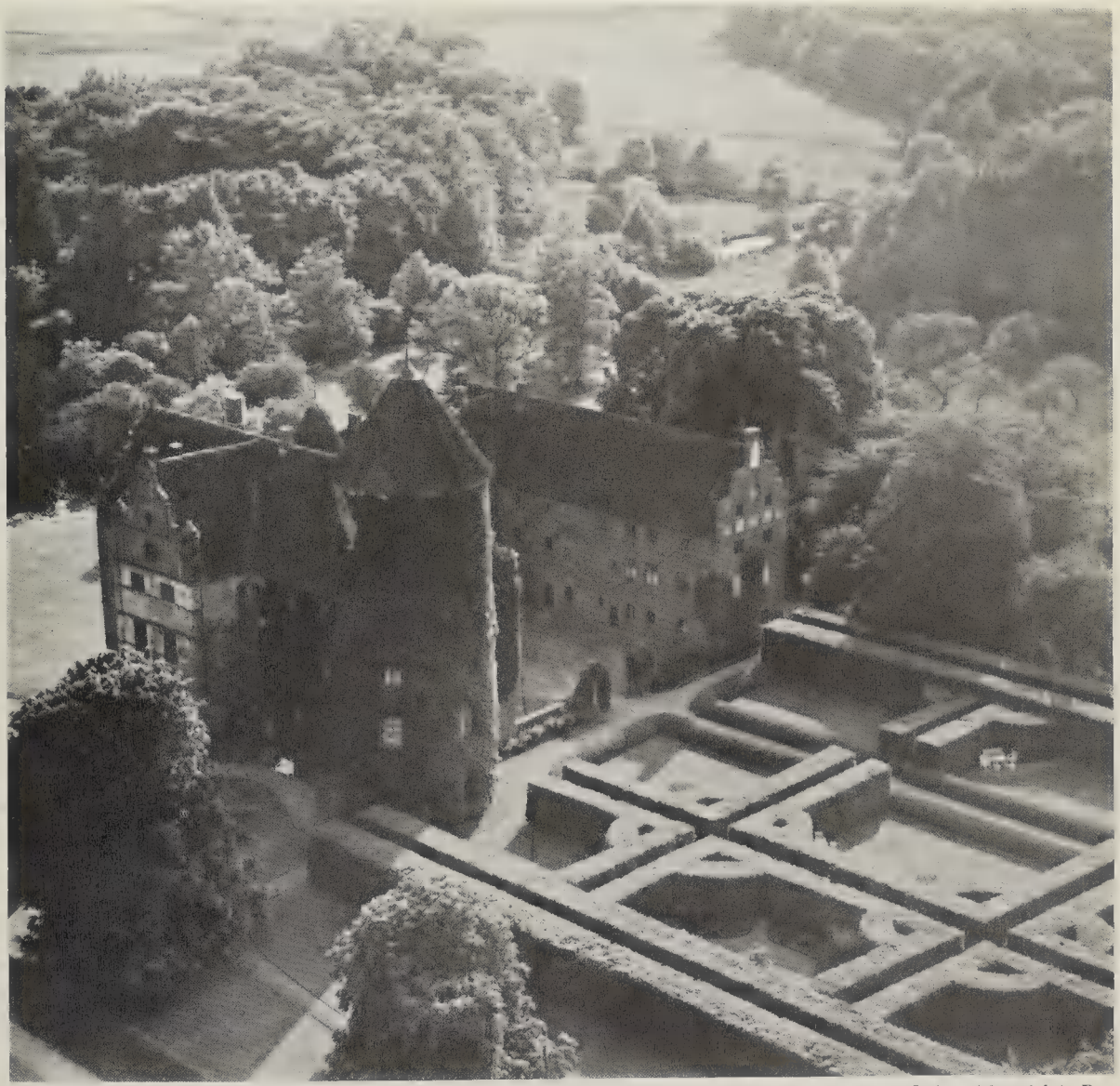
PAST WISDOM MEETS THE PRESENT

When one sits in her great dining hall, against whose dark, shimmering, gilt-leather tapestries every one looks like an old portrait, and listens to her talk of the present and future, one is surprised by the sensibility and acuteness of hearing with which she catches what is happening outside in our unquiet world. It is not often that one finds a person in her position so untrammeled in the search for understanding and courageous in taking up a position.

And one sees why she has had these words cut over the hall mantelpiece: "Houses and families have stood long enough; if they stand still they fall with honor."

Skåne is commonly called "the granary of Sweden"; and we who come from this, the most southerly and most blessed province, are intensely proud of it. Bordered by the sea on three sides, it lies there with its fertile fields and leafy beech woods, dotted with smiling country mansions and stately castles. Nowhere else are the gardens so rich and full of color, nowhere else is the prosperity so marked.

The people are masterful and rather self-confident, quietly good-humored and fond



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TO SKARHULT'S TOWERS CLING ROMANCE AND IVY

In parts of this great house, built long before Plymouth was settled, the windows remain at an angle as they originally were placed to facilitate shooting from them. The farm buildings and gardens, with their geometrical box hedges, are among the finest in Sweden. The present young owner has become an expert in the history of art, and has specialized in research on country houses (see Color Plate V, lower).

of a joke, sunnier and with more savor than the rest of the Swedes. But they are able and brave, too—Charles Lindbergh's family came from that province.

Big country houses lie all along the seacoasts of southern Sweden, and still thicker in Västergötland, so rich in ancient memorials, south of Lake Vänern. On the northern side of the lake is Värmland, whose old family legends and traditions have been made known far outside the boundaries of Sweden by Selma Lagerlöf's poetical descriptions (see Color Plate VIII).

But most of the great country houses of central Sweden, and the finest, are to be found in the provinces which abut on long Lake Mälaren, at whose exit to the sea Stockholm lies.*

It was there especially that the primeval people of Svea lived; thence sprang Rurik, who laid the foundations of Russia, and the Vikings who ravaged the Mediterranean coasts; and it was there that Christianity was first introduced into Sweden.

Foundations and a few massive stone houses still survive from this long-vanished time, and in certain cases the same family

* See "The Granite City of the North (Stockholm)," by Ralph A. Graves, in the NATIONAL GEOGRAPHIC MAGAZINE, October, 1928.

Photograph by Otto Ohm

MANY CELEBRITIES ARE ENTERTAINED AT TORUP

The talented chatelaine, Baroness Henriette Coyet, is showing her herb garden to her friend, the world-renowned author, Dr. Selma Lagerlöf. Winners of the Nobel prizes (awards that are granted for outstanding work in chemistry, physics, medicine, literature, and peace, through the generosity of the will of the Swedish chemist and engineer, Alfred Nobel) and other distinguished visitors to Sweden usually are entertained at this medieval castle (see text, page 10, and Color Plate IV).

has lived on the same property for three or four centuries. There are estates which for 500, or even 600 years, have been handed down from one generation to another without ever being sold, though these, of course, are rare exceptions.

LIFE ON A SMÅLAND ESTATE

Many lie far from the towns, so that none of the modern thirst for superficial, exciting pleasures has yet found its way to them; that is why the old Swedish traditions in all classes of society are more firmly rooted there than anywhere else.

I will give an example of what life can be like in one of these old Småland properties by describing my aunt's house, Odensviholm, where I passed several weeks last autumn.

In her house everything is still done in the old style, just as in her late husband's time (see opposite page). There has never yet been a strike or a trades-unionist on her estate, and the only Communist in the parish complains loudly that the workmen are so satisfied that the most ferocious Soviet propaganda has no effect upon them.

Although the communal almshouse is extraordinarily pleasant and comfortable, and its standard of living fully meets the exacting requirements of the Swedish working class, none of my aunt's retainers will go there. Widows and feeble old men refuse to give up their work so long as there is any possibility of their continuing it. They regard it as their absolute right to avoid being pensioned off, and prefer to earn a coin now and again in addition to their ample revenue in kind. It is, more than anything, their homes that they are reluctant to leave.

Their attitude is more than understandable when one sees their well-built, comfortable cottages, painted red with white corners, window frames, and verandas.

Each has its well-kept garden plot full of vegetables, fruit trees, and all kinds of ornamental old-fashioned flowers; and they stand in the most picturesque situations, on the shores of the lake and clearings in the woods. Even the laboring class in Sweden has an unusually well-developed feeling for natural beauty.

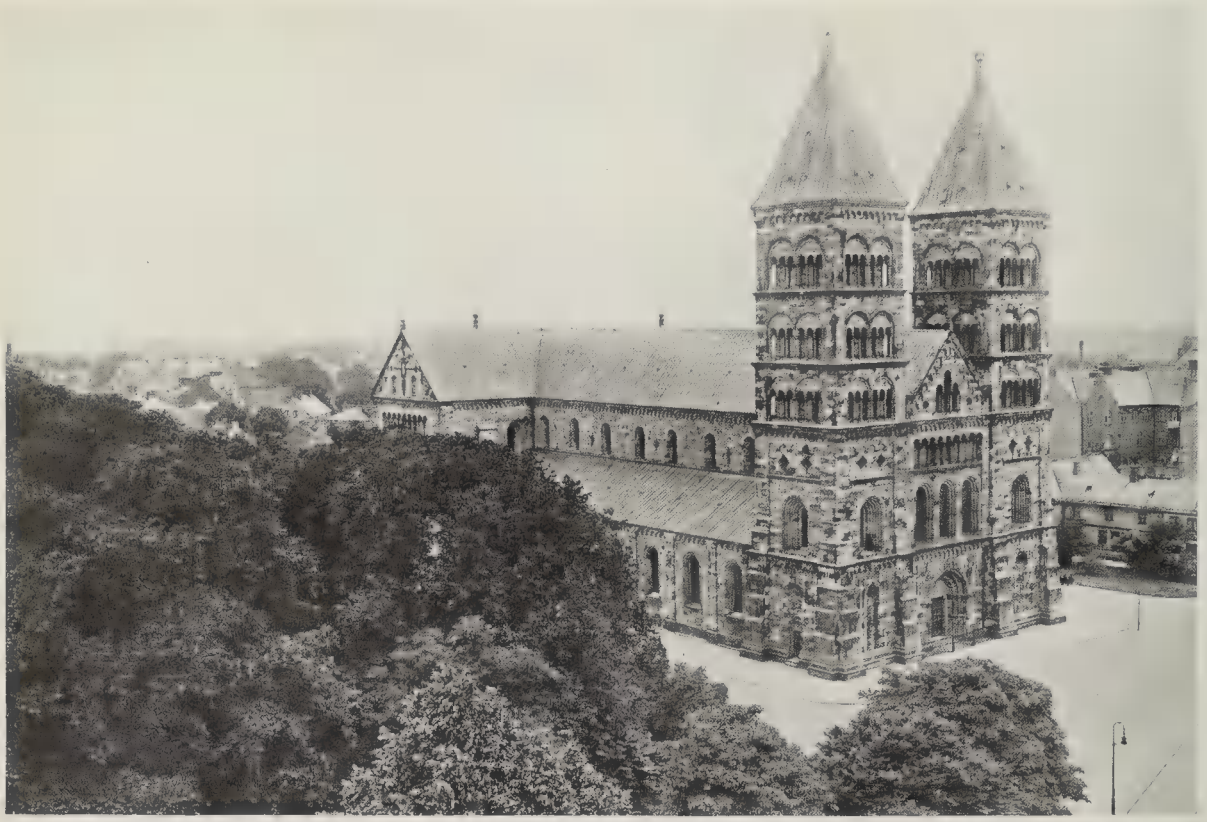
FOR TWO CENTURIES LIFE HERE HAS KEPT THE EVEN TENOR OF MEDIEVAL WAYS

The mistress of this country house at Odensviholm, Småland, is the author's aunt. After every meal she would personally put away the sugar and cakes in the larder, lock the door, and then hang the key on a nail close by! (see text, opposite page). On each side of the broad courtyard is a long, low visitors' wing and a few huge limes. On the other side of the large building a well-kept garden runs down to the lake.

Photographs © by E. Lundquist

DIGNITY MARKS QUEEN CHRISTINA'S BEDROOM AT TIDÖ

The castle, overlooking the waters of Lake Mälaren, is preserved to-day essentially as it was when it was a seat of the Chancellor Oxenstierna. Only six years old when her royal father, Gustavus Adolphus, was killed, Christina was educated in boyish pursuits principally by Johannes Matthias, while the Chancellor tutored her in politics. She came to the Swedish throne in her eighteenth year, but abdicated ten years later in favor of her cousin Charles, whom she had refused to marry (see illustration, page 58).



Photograph by G. Heurlin

LIKE "THE MIGHTY FORTRESS" OF LUTHER'S HYMN IS LUND CATHEDRAL

Parts of this building date to the early years of the Reformation. Then the city was the seat of the Archbishop of all Sweden. Before that, until 1658, Lund was a Danish town. The interior has a richly ornamented pulpit of the 16th century, carved choir stalls, and many early paintings.

Of course, it is hard to run and finance a large agricultural estate when scruples forbid one to get rid of all these old people, who are getting slower and slower on their feet, though naturally only younger labor does the heavier work, particularly the exhausting toil of tree felling.

NEW TREES PLANTED FOR THOSE CUT DOWN

Of the 12,000 acres in the estate the larger part is forest, and this is kept in exemplary order, despite the bad times, although for the moment it does not pay. The orders of the forestry board, that "every one who cuts down a tree must see that it is replaced by a new one," are literally obeyed.

This excellent and powerful board, which has existed for 28 years, is probably the principal reason why Sweden has such excellent and efficiently managed forests. They cover a total area of 58,000,000 acres, or nearly 60 per cent of the whole soil* (see illustration, page 16).

* See "Sweden, Land of White Birch and White Coal," by Alma Luise Olson, in the NATIONAL GEOGRAPHIC MAGAZINE, October, 1928.

As first-class as her management and preservation of the forests, and as good examples to the whole district, are my aunt's orchards, piggeries, and fowl houses. She is also honorary president of many pomological and ornithological societies, and she initiated a large coöperative egg-exporting association.

Formerly cheese and butter, too, were produced on the estate on a large scale, but now the landowners and farmers of the district have joined forces and set up a large joint dairy. Despite the 21 miles to the nearest small town, the dairy is tiptop, with modern machinery and all the most elaborate refinements of the day.

"TIME IS MONEY"—BUT NOT TO MY AUNT!

On such an estate, old and new are mingled in the funniest way. It amused me to watch my aunt, after every meal, march into the larder with sugar bowls and cake dishes of the heaviest, handsomest family silver.

When she had put aside what was wanted for the next "snack"—they are always drinking coffee at my aunt's—she carefully

Photograph by Ragnar Kuller

SKABERSJÖ'S MANY CHIMNEYS ATTEST THE SWEDISH AVERSION TO CENTRAL HEATING

The fireside is the heart of the large country home (see illustration, page 3). In the château where the author stayed a rosy-cheeked country girl, in blue dress and white apron, would call mornings, curtsy, light a fire of birch wood, and close the windows (see text, page 18).

and ceremoniously deposited each of the numerous varieties of cake and biscuit in pewter boxes divided into compartments intended to contain them. I assume that this habit was a survival from a time when sugar was a rare and valuable import article and servants not so austerely reliable as they are now.

That the rite was not due to the faintest shadow of suspicion of the staff was clearly shown by the fact that after the larder door had been most carefully locked, my aunt hung the key on a nail close by, as visible and accessible to possible pilferers as could be desired!

The locking of that door, by the way, was something exceptional; for, although the house lies right on the highroad, the entrance door is not shut all day long.

The feeling of security, even nowadays, is so great in the Swedish countryside that on my last visit I slept everywhere with wide-open windows on the ground floor, without ever having the slightest feeling of discomfort or insecurity—and this even in cases where the house was peculiarly lonely and quite close to the highroad.

In one place I observed that the 19-year-old daughter of the house had taken up her abode in the guests' wing. During the long periods when no visitors were present she slept there alone, without a bell or any means of making herself heard in the main house if anything should happen—and this on an estate only three miles from the nearest industrial center, where unemployment was causing much disturbance and mischief!

She laughingly explained that in her home illness and thieves were not things one took into account, and that she was much too comfortable in her lovely little maiden chamber to abandon it out of cowardice.

A DINNER FOR SIXTY

But, to keep to my aunt's home, it bears in the main, like the majority of the Småland country houses, the imprint of 18th-century taste, with a touch of Empire and "Biedermeyer" here and there. On the ground floor are some visitors' rooms and the dining room, the latter in white with lacquer-red walls above the paneling, against which a fine collection of old pewter shows

Photograph by G. Heurlin

EVENING GILDS THE WATERS OF LAKE SILJAN

Noted for its scenic beauty, this lake has been given the delightful title, "The Eye of Dalarna." Logs, made into large rafts, such as those seen in the foreground, are floated through the lake and down river to sawmills. Because the forestry board of Sweden decreed that "everyone who cuts down a tree must see that it is

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FROM THE DAYS WHEN KNIGHTS WERE BOLD AND GUARDED STOUT CASTLES, WITH WIDE MOATS AND FROWNING TOWERS, DATES VITTSKÖVLE

This imposing 16th-century stronghold was built by the illustrious Brahe family of soldiers, has more than a hundred rooms, and, like most of the other country houses, contains many paintings that have been acquired through the centuries by its wealthy masters (see Color Plate I).

up admirably. We have dined as many as 60 there in former days, before the crisis and restrictions put a check on the old, well-known hospitality.

Next to the dining room is the library, where the family is accustomed to gather by the fire. Not only are there many books in handsome old bindings, but also a large number of real Chippendale chairs. I remember how we sought them in attics and servants' rooms when my aunt and uncle moved into the main building after their predecessor's death.

On the first floor is a suite of sunny sitting rooms with beautiful stoves, doors, and lintels. The walls are divided into panels painted in different light colors and hung with good pictures and, of course, the usual family portraits. There are thin white curtains in front of the high windows, and among the furniture and ornaments are many valuable pieces from past centuries.

But all the floors are made of painted or unvarnished fir beams, the latter scrubbed with soap and bass brushes. Most of them are covered with narrow mats woven at home from left-over cotton rags; they have a bright and cozy appearance, typically Swedish in their cleanliness and simplicity.

Of course, there are neither motorcars nor electric light at a place of such conservative traditions, but carriage horses and honest old paraffin lamps, besides candles in wall scones and candelabra. Central heating is an unknown abomination, which is considered good enough only for the smaller domestic animals or the town dwellers! In this respect most Swedish country houses are alike; the owners prefer to heat with their own wood in large open fireplaces and old porcelain stoves with pure lines and tasteful ornamentation.

THE FIRESIDE IS THE HEART OF HOME

The fire plays a prominent part in Swedish home life. Around it the family assembles of an evening, whether it lives in a luxurious flat with central heating or in a single room in the city, in a ready-made suburban villa, or in castle or cottage in the country.

A moment when the atmosphere of a Swedish country house is especially concentrated and full of charm is when one awakens in a big white guest-room bed of elegant 18th-century proportions. It is just as exquisite, whether a pale autumn sun is shining into the room through the small-paned windows or the snow is falling silent and thick out in the winter dawn.

A rosy-cheeked country girl in the traditional light-blue cotton dress and white apron comes in, curtsies, and wishes one good morning; then she skillfully lays and lights a big fire of birch wood and shuts the window. While the room is growing warm, one lies in bed relaxing, listening half in a doze to the cheerful noise of the fire as it crackles and throws off sparks, and blinking at its reflections on the flowered wall paper and old engravings.

THE SECOND GONG SOUNDS!

There are modernized houses where a sybaritic breakfast tray is carried in to one in bed by a housemaid, or is actually pushed in on a vehicle by a correct manservant; but somehow there is not then quite the same pleasure and the same traditional atmosphere as when one has to hurry to be ready by the time the second gong sounds.

Then one remembers one's youth, and the breathless rushes across the courtyard outside the visitors' wing, and the looks of disapproval and annoyance that met the poor sinner who happened to be even a minute late when the family stood behind their chairs with folded hands and said their grace.

To be late was an especial sin on Sunday morning, when there was not only a sermon, but also a thick, freshly baked pancake with jam to eat with the coffee, instead of the monotonous porridge and ham and eggs (or herring and potatoes) of ordinary days. But it was not so easy to be punctual, I assure you, after the singing games the evening before, and the early night's fun or reverie under loaded fruit trees.

Oh, *hampusar* and transparent *astrakaner* of my youth—how incomparable you tasted on such a moonlit evening! You were no longer Swedish apples, but the most wonderful sherbet, the lordliest Moselle wine—flowing nectar and ambrosia.

And, oh, my youth's dear kinsfolk of the older generation, how much more colorful and thrilling life was when we still had your prohibitions to defy and evade—when, with a delicious shudder at our own daring, we risked a grand-paternal thunderstorm and felt that it was worth it!

Many youthful memories streamed back into my mind at the dear old place. There were, too, a variety of things which had formerly made no impression upon me

Photograph by G. Heurlin

LEKSAND'S BULBOUS DOME SUGGESTS THE RUSSIAN INFLUENCE

Lars Siljestrom, who served as military chaplain with Charles XII when that Swedish warrior-king was beating down the coalition of Denmark, Poland, and Russia in the Great Northern War, directed the building of the church and gave it this distinctive tower. Some of Sweden's older religious edifices have a separate bell tower which stands apart from the main building (see page 52).

Photograph by Donald McLeish

A PLEASANT VIEW OF LAKE SILJAN AND HISTORIC MEMORIES ARE RÄTTVIK'S HERITAGE

On the site of the old church Gustavus Vasa first summoned the inhabitants of the district to battle for Sweden's independence from Norway and Denmark. On

Photograph by Donald McLeish

FOR NEARLY FOUR CENTURIES THIS CASTLE HAS DOMINATED UPPSALA, THE OXFORD OF SWEDEN

In the mighty structure founded by Gustavus Vasa many incidents in the nation's history have been enacted. Here Erik XIV brought death to Count Sture before he was deposed, and here the celebrated Queen Christina abdicated (see illustration, page 13). The building is now used as the residence of the Governor of the province and partly as an arsenal. Uppsala is the seat of the famous university of that name, which opened its doors before Columbus sailed to the New World.

Photograph by Nordiska Museet

ABOUT HÖRNINGSHOLM'S WINDOWS HANGS AN INTERESTING TALE

In an earlier building occupying this site, the future general, Jan Baner, was born, and, as a child, fell from a third-floor window without injuring himself. The Thirty Years' War might have had a very different outcome if this mighty soldier-to-be had not been "borne up by angels' hands." The château, rebuilt after having been burned by the Russians in 1719, stands on a steep cliff in Södermanland, overlooking the Baltic.

whatever, but which now caused me a quite new and peculiar emotion; for example, when my aunt showed me her spacious linen room with the cupboards ranged against the walls. When she opened them, I saw the shelves filled from floor to ceiling with lovely lavender-scented piles of linen. Between the different kinds of cloth unvarnished wooden pegs were inserted, and from each hung another narrow strip of wood.

TABLECLOTHS HAVE STATELY NAMES

When I looked more closely at them, I saw a roster of names: the old baroness, the bishop's wife, her ladyship from some distant estate, and so on. My aunt explained that the names were those of ladies, now long dead, from whom the patterns had originally been obtained, and that these patterns had been perpetuated.

The names of the ladies had gradually been transferred to the cloths themselves, so that nowadays the maids received orders to lay the Sunday dinner on Countess Rudenskjöld, and to serve the afternoon coffee on the dean's widow Liedholm.

There were fine damasks of silky sheen and graceful, old-fashioned design, and frankly coarse, rough-surfaced huckabacks of homely rectilinear pattern, the newest still unbleached and a lovely golden gray.

But when on a shelf, right at the bottom, I discovered the word "Stockholm," my dear aunt blushed as if she had been caught in some disgraceful act, and said, "Oh, no; never mind those; they are *bought* cloths!"

The tone of her voice was delicious to hear, full of disgust and shame at such parvenus having insinuated themselves among her jealously guarded treasures.

When I saw all this, I understood better a conversation we had a short time before. She had spoken of the bad times, and how she, like every one else, had been forced to cut down expenditures—on servants, among other things. Formerly the household had kept eleven women servants, including the housekeeper; now she had only six maids, and she felt the difference.

I thought six ought to be enough—at any rate in winter, when there were no visitors

Photograph by Nordiska Museet

SKOGAHOLM CHÂTEAU NOW STANDS IN SKANSEN PARK

In 1891, Dr. Arthur Hazelius founded an open-air museum, called Skansen, in Stockholm, where the natural history, ethnography, and architecture of Sweden could be graphically illustrated. In a 70-acre enclosure are presented the highlights of the country. The removal of this mansion to the grounds was a recent phase of the enterprise. The ceiling and walls of this bedroom are distempered in umber and black on a gray background. The bed is covered with a green mosquito net.

except at Christmas; but she reminded me of all the work there was to be done. There was the great autumn cleaning, when double windows had to be put into all the rooms and pasted up, to be taken out again in the spring with equal labor! There was the slaughtering and preserving and jam-making on a large scale; the married children must have all they needed from home.

WASHING 800 PAIRS OF SHEETS!

And, beside ordinary laundry work, there was the great wash twice a year, when all her cloths and 800 pairs of sheets had to be washed in due order, whether used or not, so that they might not turn yellow.

But, above all, there was the weaving of curtains, cowhair and rag mats, and all the linen. The four looms had to be at work the whole winter if they were to get through the year's flax harvest which the old women of the estate had spun.

When I saw what masses there were already, I could not help expressing a little blasphemous wonder whether in our days it could really be considered so absolutely necessary thus rigidly to follow the well-worn ruts of ancient usage.

But I was checked by her reproachful look. She raised her head with a beautiful dignity, and said that ever since the place had existed its mistresses had not only kept intact the store of linen they had inherited, but had done their best to increase it, so that all the children had been satisfied when it was divided after their parents' death.

Even if she did not succeed in riding out the storm, even if she were to be the last of the long line of house-mothers, she would not on that account fall short of her predecessors, but would conscientiously and honestly execute her task for so long as it might still be entrusted to her.

As she said this, she seemed to grow in stature; a waft of predestined greatness swept over her figure as she stood there in the cool, bright linen room.

It is not in material things alone that she has handed on to the younger generation a precious heirloom. From her father, Gunnar Wennerberg, whose songs are still loved and sung wherever Swedes are

Photograph by C. G. Rosenberg

FIVE-STORY SVANEHOLM IS THE "SKYSCRAPER" AMONG SWEDISH CASTLES

As originally built in the 16th century, it had only three floors; the other two were added later by Axel Gyllenstjerna. Surrounding the lake are beech trees, and in the park of the estate are heavy oaks 800 to 900 years old.

© Aëro Materiel A. B.

STEPPED GABLES CHARACTERIZE MEDIEVAL MONASTIC ARCHITECTURE IN SKÅNE

Bosjökloster was a 12th-century Benedictine convent, which, when the Reformation brought Protestantism to the country, became a present to the Archbishop of Lund (see Color Plate IV). Later it became hereditary in the Ulfstand, Beck-Friis, and other families. The interiors are richly furnished, with open hearths and painted hangings.

gathered together in the Old World and the New, music came into her blood and that of us all. She is an amateur singer of note, all her children were born musical, and two of them have trained to become professional musicians.

HOME FIRST, CAREER FORGOTTEN!

The youngest of them was already well on the road to make a name for himself as a pianist in some European countries and farther afield. But then the brother who was managing the estate died, and when it became clear that they had to choose between sacrificing the family property and abandoning music, it was the latter that had to go to the wall.

Now the singer goes about the fields, stables and cow house from morning till night, or she sits and plugs at figures in the office and makes superhuman exertions to balance expenditure and revenue.

The pianist goes through the woods, his head, too, full of figures. He supervises felling and planting, and does not let himself be distracted by the song of the birds and the rustle of the wind in the firs. Not till the two come home in the evening, tired out by the day's long toil, do they allow themselves an hour's music at the big piano; but then the music is of the highest quality.

It still happened sometimes that their mother joined in and sang second when one of her favorite songs was struck up. Neither age nor cares nor sorrows have conquered the good old-style training and the noble ring of her deep contralto.

Over at the great table sat another of my mother's sisters, 76 years old—ethereal, spiritualized, and evergreen. She was either working at her latest book or reading the proofs of her son's. She follows with never-failing interest the questions and spiritual movements of the day; and the books and magazines which are read aloud of an evening in this remote corner of "darkest Småland" are on an astonishingly high level.

Those people have not forgotten their ancient mission as pioneers of culture and spreaders of enlightenment; they remember that amid all the cares and worries of daily life there is "one thing which is necessary."

On Saturday afternoons "the baroness's church carriage" was driven up to the door. It was of peculiar and rather comical structure, low and wide; it had been built for my aunt at a time when, owing to an injury to her foot which lasted a considerable time, she could not climb up into the high family barouche. Custom demanded that the driver of the "church carriage" leave off livery, and that he use two of the heavy cart horses; and, equally, that the passengers should be clad in their simplest and most unfashionable outer garments—perhaps as an unconscious sign that they were on an errand of piety and introspection (see illustration, page 9).

The carriage was filled with wreaths and bouquets of flowers which all had passed the morning picking and tying up, to be laid on the many graves of our family. The ceremonial was no mechanical rite, but something demanding loving consideration; the dead had each of them to have the kind of flowers they liked, or which resembled them externally or inwardly.

It was a long time before my aunt was satisfied with the result; she took her task with the utmost seriousness. Some of her children and grandchildren helped her, and while she went to and fro, and with her own hands tended the graves where rested her parents, her brothers and sisters, her husband and sons, and so many of her other relatives, once more she seemed to me to grow beyond the personal and incidental, and become a kind of living symbol of fidelity and remembrance.

CHURCH BELLS AND AUTUMN FLOWERS

In her warm heart these departed all tarried, as alive as when they still walked the earth. As long as she was still there, none of them should be really dead and gone, none faded into oblivion.

Just then the bells began to ring in the whitewashed tower of the old country church. Their sound was wafted out over the wood-encircled lake, which lay there so still and shining and reflected the little red cottages and the great pale-hued mansion.

Everything was clear and clean—the autumn flowers gleamed bright against the rust-red timbers of the rectory, and among the crab apples and white-birch trunks in the paddock a gentle old man walked hand in hand with a couple of flaxen-haired, blue-eyed little girls dressed in light-check cotton frocks.

I drank it all in with greedy eyes and I felt with a sting in my heart that this was Sweden in essence, the land of my childhood and youth.

Photograph by Alfred B. Nilson

SUNDAY MORNING GREETINGS OUTSIDE THE CHURCH

At this little seaport town of Simrishamn, Skåne, as elsewhere in Sweden, the people often don their traditional costumes for religious services and on holidays. The stair-stepped gables, which give the tower such a modernistic appearance, are features of the church architecture in southern Sweden.

When I turned my head I saw my aunt, too, standing there with folded hands listening to the bells. In her face was the same indescribable peace that lay over the whole landscape, bathed in evening sunshine, and in its lines the same silent grandeur.

ODD OLD CUSTOMS STRANGELY SURVIVE

I found an echo of the Sabbath eve bells in the clear, melancholy gaze with which, after a well-spent working day, she looked out over her broad possessions.

As far as possible she had done her duty, discharged the task laid upon her, faithful to the last, however uncertain the future toward which her retainers and descendants were marching.

One of the things which always struck me afresh on my visits to big Swedish country houses was the peculiar duality that prevailed there—on the one side, the modern spirit of progress and exploitation of all the latest technical inventions; on the other, so stubborn an adherence to ancient customs and traditions.

In my childhood bathrooms were still rather uncommon, and, where they existed, remarkably primitive, with clumsy bathtubs of wood or sheet-iron. But now, of course, it is quite different. The change came during the first ten years of this century.

But, as the result of inadequate sanitary arrangements, there are still many places

Photograph by J. Stenhardt

THE BREAD BOX IN THIS PANTRY HANGS FROM THE CEILING

The coarse, home-baked *tunnbröd,* impaled on a pole, is thicker and softer than *knäckebröd,* described by the author (see page 30). Old copper molds and pewter services cover the side walls, and on the floor are large vessels in which wines are made from berries and fruit. An array of objects, similar to this at Olivehult, is found in many Swedish country houses (see illustration, page 45).

where certain other conveniences are installed in some natty little summer house out in the grounds. These are usually round or octagonal, divided in the middle by a partition wall, and provided with two entrances at opposite ends—one for ladies, one for gentlemen. They are as agreeably inviting as they are spacious in their dimensions. They often have muslin blinds in front of the windows, old-fashioned rosy wall paper, and comfortable seating accommodation for four or five persons.

When I refused to take part in the usual mass processions to these places, one of the girl friends of my youth grew quite indignant, and said it was sad to see how corrupted and perverse I had become from living so long abroad. She, thank Heaven, had learned from her childhood up that *naturalia non sunt turpia*—and on the staircase of her ancestral castle the good, honest old convenience for two persons still survived unchanged.

She used to visit it with her husband, and these confidential little chats over a cigarette often proved so pleasant that they took their time over them. And then it happened that her old father and mother had to stand outside waiting impatiently till their turn should come.

I do not mean to say that this kind of thing is frequent, but to this friend of mine it was as natural and as much a matter of course as having a bath in her husband's company.

If one looks at the phenomenon from a historical standpoint one quickly comes to a clearer understanding. We are not compelled to go back to the Middle Ages to find a parallel. As late as the times of Louis XIV and even Louis XVI such unvarnished habits were generally accepted, and no one was surprised at them. And these, like so many other old customs and traditions, have happened to survive at some places in the Swedish countryside.

They are, for that matter, only a minute detail in the mass of other more important things. Every season has its feasts and holidays, which are faithfully observed and celebrated with ancient ceremonial. There are still isolated estates and villages in Skåne where "the cat is knocked out of the cask" by costumed lads on horseback, or where the boys go from house to house and "sing in May," while they decorate the house doors with beech boughs in new leaf.

Easter is celebrated throughout the country with eggs painted or bearing verses, and on St. Walpurgis' Eve (the night of April 30) great fires are lighted on the hills and the boys and girls sing round them at the tops of their voices till the sun rises. It is their way of welcoming the spring and driving away the long, dark winter.

RANK FORGOTTEN ON MIDSUMMER EVE

Midsummer Eve is another vigil. Then maypoles decked with green leaves and garlands of flowers are set up on every estate, and squires' daughters dance with agricultural laborers, factory hands with farmers' wives, and servant girls with schoolmasters, inspectors, and the Lord of the Hall. On that night there are no differences of class or opinion, and the old bonds that unite master and tenant are closer than ever.

Not even the crisis can kill the rejoicing, when violins and concertinas make hearts beat quicker and set the feet going. And there seems to be good reason for the fact that so large a percentage of the country population of Sweden have their birthdays in the last week of March.

In August come the harvest festivals, with dancing and eating and drinking on the threshing floor, and the characteristically Swedish crayfish-catching, followed by cheery al fresco suppers, with singing and fireworks, or at least colored lamps. Perhaps the Swedes "let themselves go" more on these occasions than at any other time. That mingling of dill-scented, fiery-red crustacean, ice-cold brandy and Moselle, August moonlight and natural beauty has been, ever since the poet Bellman's days, singularly potent in evoking the Dionysian side latent in these people, somewhat stiff and heavy in daily intercourse.

We had a king who went to sue for the hand of Queen Elizabeth of England. He was rejected, but he brought with him the first crayfish which were released in Swedish fresh water; and many a sigh of gratitude have the Swedes uttered since then at thought of what might have happened if he had brought home the troublesome lady instead!

In the autumn comes the shooting of different game. The four days in particular on which elk shooting is allowed are a great and solemn occasion, eagerly celebrated all over the country.

But to get a real idea of Swedish country life, its delights and its peculiar charm, one

Photograph by Almberg and Preinitz

NOT UNTIL THE HOLLYWOOD PERIOD DID SUCH ORNATE BATHROOMS REAPPEAR

Italian stuccoes and sculptures adorn the lavatory in Eriksberg Castle, with its two finely chiseled copper baths. These, apparently, provided facilities for several members of the family at one time (see text, page 50).

must have spent Christmas in one of the old houses.

The preparations have been in hand since the middle of November; an ox, several calves, and a number of pigs have been slaughtered, cut up, and stored away, along with the game, in an old-fashioned ice house or modern refrigerator. (Both ice and electric power are obtained free from the estate.)

Countless preserves and sausages are prepared; salting and smoking are done in special houses, the most important feature being the hams and the whole pigs' heads, which later, attractively decorated, are to adorn the Christmas table.

And then there is the *lutfisk* (dried cod) to be cured for three weeks, and the Christmas beer to be brewed, sweet and strong and powerful. Every self-respecting family has its own hereditary recipe, and if possible a jar of yeast which has been renewed and diluted for 150 years and, in some cases, even much longer.

ST. LUCY SPONSORS YULETIDE BAKING

On St. Lucy's Day, December 13, one is awakened early by a girl, one with long, fair hair if possible, wearing a white nightgown and a wreath of fir twigs round her head, from which seven lighted candles shine out in the dark winter morning. She serves coffee from a three-legged copper bowl and *lussekattor*. These are somewhat round, swastikalike saffron buns with raisins in them, and date much further back than St. Lucy herself. Similar pastries, as hard as stone, have been found in our Viking graves and prehistoric barrows.

From St. Lucy's Day the Christmas baking begins in full earnest. Much could be said of all the different kinds of *knäckebröd,* spiced bread, buns, and cakes which are made; their history, too, goes often far back. But it would take too long.

Every corner must be made bright and clean, all the white wooden floors scrubbed, all the copper and silver polished till it shines like the sun. So when the morning of Christmas Eve comes, a real festival spirit prevails throughout the house and estate.

A cow and two pigs have already been distributed among the people on the property; the beasts, too, get an extra ration, the

game in the woods as well, and corn sheaves with scraps of lard are put out in the snow for the small birds which have not migrated.

In the old family mansion I specially have in mind, 150 children from the estate are invited to drink coffee in the dining room at lunch time. Each has a high "Christmas pile" in front of his plate—clothes, toys, tasty bits of Christmas sausage and cake, crowned with a huge gingerbread figure cut to the shape of a goat, known as *julbock*. In the middle of the table is the children's own tree, which they are allowed to plunder afterward.

In the afternoon several members of the family drive round with Christmas baskets for old or sick dependents. Others go to the churchyard with fir wreaths and little Christmas trees covered with candles, while some stay at home and seal up the last parcels, or write verses on them. The entire house is filled with a sweet and promising smell of sealing wax.

Photograph by O. Borberg

"BE CAREFUL! IT IS 600 YEARS OLD!"

This gilded silver "Angsö" goblet is covered with engravings and four coats of arms depicting a red boat on a golden field. The girl is the youngest member of the family which has owned Angsö Castle since 1710.

At 6 o'clock, dressed in festal attire, we go down into the large Old World kitchen. It is gaily decorated with paper garlands and chandeliers of fir twigs and red ribbons, with mistletoe and burning candles in every corner.

When we have drunk the brandy and sung to it, we dip in the pot. This is a solemn ceremony. Each person, in order of age, advances to the kitchen hearth and, uttering a good wish, dips an enormous slice of wort bread, spicy and treacle-brown, in the house's largest copper pot. There the rich soup is bubbling in which the Christmas ham has been cooked, and we fish up steaming potatoes and pieces of sausage as well as the broth.

ON CHRISTMAS EVE MASTER WAITS ON SERVANT

When all have helped themselves, we sit down round the Christmas table, which is decked with three-armed wax candles and red tulips. On this day the servants sit at the table and the family wait and change the plates.

After the dipping the lutfisk and rice porridge are eaten (whoever gets the bean will be married before next Christmas!), and finally *klenor*, cakes of a peculiar shape, cooked in deep fat. In Skåne, where culinary possibilities are unlimited,

a roast goose with apples and prunes is also served.

Throughout the dinner absent friends and relatives are toasted—the living humorously, the dead with due solemnity. The first toast is that of "auld lang syne" and is drunk in foaming Christmas beer from a large silver cup dating from the 17th century and bearing the family crest. It goes round the table and everyone present drinks from it—in accordance with ancient custom.

A TREE OF 200 CANDLES

After dinner the company assembles in the largest drawing room round a giant Christmas tree decked with home-made sweets, gingerbread pigs, ornaments, and 200 candles. On the harmonium an altar has been arranged, with yellow tulips and wax tapers, round a picture of the birth of Christ which has been brought out every Christmas for several generations.

Then the head of the family reads the Christmas gospel, all sing the beautiful old Christmas carols and anthems in parts, and tears form in the older people's eyes, while the eyes of the youngest shine with impatient anticipation.

At last their turn comes, too. The whole household take hands and, singing as they go, dance a long and enthusiastic "Christmas polka" all over the house—upstairs, downstairs, through cellars, visitors' rooms, and attics. Not a room may be forgotten; everywhere is brightness, warmth, gaiety.

When the merry band returns to the Christmas tree, panting for breath, the largest family washing baskets are brought in, brimful of mysterious Christmas parcels. It is late at night before all the verses and jolly absurdities have been read aloud; yet nearly everybody crawls out of bed for the Christmas early service, which begins at 6 in the morning.

It is several miles to church, and we drive there, wrapped in thick wolfskin furs, in open sleighs, by torchlight. The snow lies thick on pines and firs; it muffles the trampling of hoofs and the grinding of runners. The only sound to be heard in the stillness is the rhythmic tinkle of sleigh bells near and far. There is no cottager so poor but he has placed a lighted tree or a few candles in his windows to guide and greet the drivers.

The frontages of the great houses are radiant with lights in every window; the little trees on the graves in the churchyard are aglow; but all these are nothing to the flood of light which meets the worshipers inside the church.

Although the masters, all the year round, mingle democratically with their retainers in the body of the church, on this day only they resume their old places up in the choir, under their ancestors' sculptured and painted epitaphs and coats of arms.

The great moment comes when the whole congregation rises and *"Var hälsad sköna morgonstund"* is poured out yet again under the vaulted roof, mightier and more stirring than ever. It is soon followed by other dear old Christmas hymns. The silver-haired rural dean keeps his sermon short. He knows his congregation, and that what their brimming hearts most need at that moment is not words but song.

Since it is not light till nearly 9, the return journey also takes place by torchlight. And the copious breakfast which then is laid ready for the churchgoers is one of the year's most glorious experiences.

At dinner ham is eaten—in remembrance of the midwinter feast of the oldest inhabitants of Svea. The more English turkey does not come till next day, with "waits" and the carol of St. Stephen. During the next two weeks there is a steady stream of neighbors and guests from a long distance.

Even in homes which have been forced to economize all the year round, the reckless old Swedish hospitality blazes up again. Discarded games and singing dances come into honor again instead of jazz and rumba. Children are at all the parties; it is they who receive first thought at this time.

HARDY SWEDES INURED TO COLD

I spent the Christmas season with different relatives in the country. At one large estate the house was of a modest and peculiarly homelike and pleasant type. In the middle was a small, low, two-storied building dating from the end of the 16th century, and on each side of the courtyard were long wings of one story, built in the 18th century.

I observed with envious astonishment how hardened the members of the family were, and how, in the middle of a freezing cold winter, they ran to and fro from house to house without any kind of overcoat—the women, indeed, in thin evening dresses.

In every country house there is one evening rite which is never left to the

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Natural Color Photograph by Gustav Heurlin

STILL WATERS OF A MOAT REFLECT THE POWER OF OLD DENMARK

Hoary castles, once the seats of powerful nobles, abound in Skåne, Sweden's farthest south. Some, such as Vittskövle (see pages 8 and 17), were built by the Danes when this rich and fertile province, "the granary of Sweden," was under their rule.

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Natural Color Photograph by Gustav Heurlin

KING GUSTAVUS III ACTED ON A PRIVATE STAGE IN DROTTNINGHOLM PALACE

He wrote plays and gave sumptuous banquets and entertainments in this castle on the shores of Lake Mälaren, near Stockholm. Costumes, scenery and "props" used in his performances are still exhibited in the theater. Even to-day the royal family like to sojourn here, especially at Christmas.

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"GOOD DAY! THANKS FOR OUR LAST MEETING!"

Thus a young lad of Skåne greets his sweetheart as he calls to escort her to church. Many villages in Sweden had forgotten their traditional costumes; now they are wearing them again, after retrieving the designs from the Northern Museum in Stockholm.

Natural Color Photographs by Gustav Heurlin

BY THEIR APRON STRIPES, THEIR PARISHES ARE KNOWN

Broad, horizontal bands of black, white, dark green and red indicate that the seated young lady hails from Rättvik, on the shores of silvery Lake Siljan. Her apron is sewn to a dark blue skirt. The friend is from Leksand, nearby, where the girls favor loose-hanging aprons with narrow, vertical stripes.

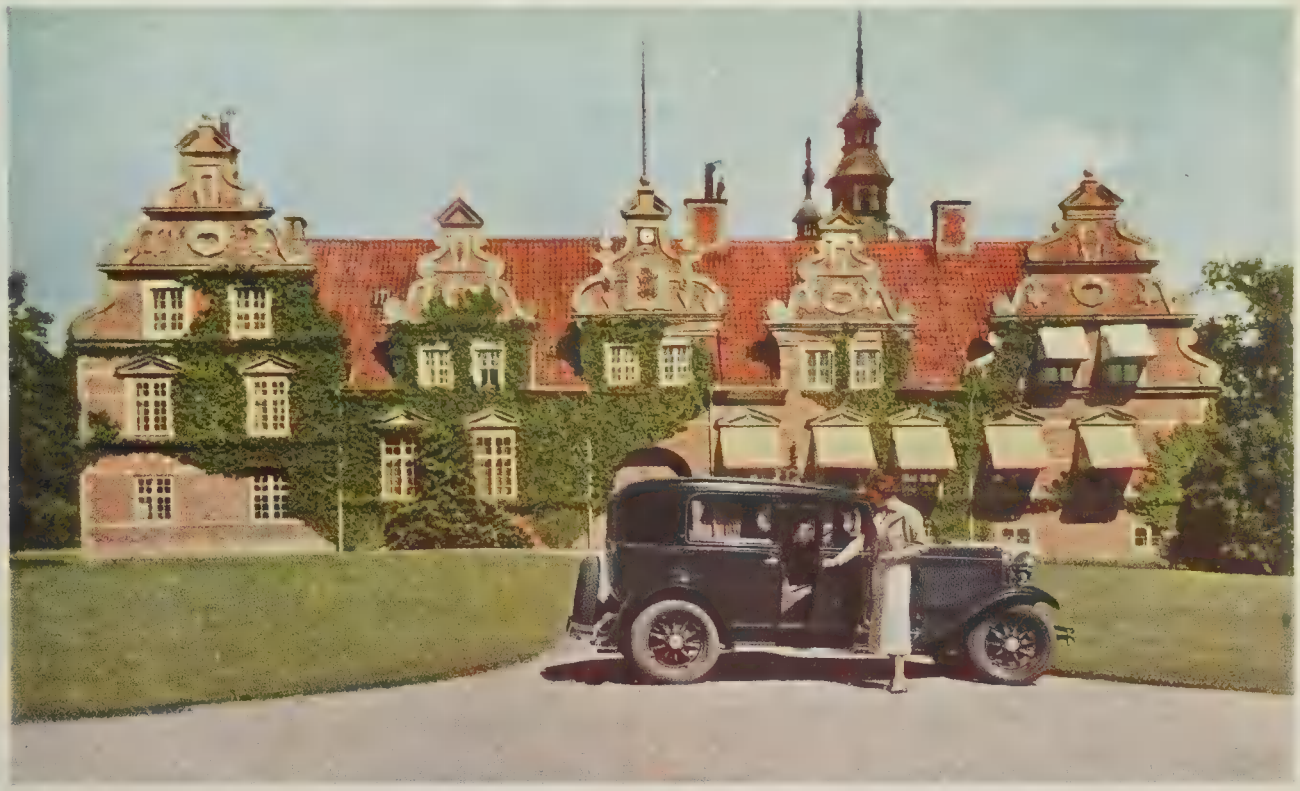
BOSJÖKLOSTER BEGAN LIFE AS A CONVENT THREE CENTURIES BEFORE COLUMBUS

Isolated on a peninsula jutting out into the Ringsjön, its buildings are as much off the beaten highways to-day as they were when the site was chosen as a retreat for Benedictine nuns. The stepped-gable roof (right) is a heritage from Denmark (see illustration, page 25).

© National Geographic Society Natural Color Photographs by Gustav Heurlin

WHERE BATTLE MOATS WERE TURNED TO ROSE GARDENS

As the need for them lessened, the owners of Torup castle filled in two of its deep ditches and replaced them with gardens, which even to-day naturalists and laymen from the world over come to view (see text, page 8).



IVY MASKS THE ORNATE FACADE OF VRAMS-GUNNARSTORP

Built shortly after the Pilgrim Fathers landed at Plymouth, this castle in Skåne indicates the early trend toward German and Dutch architecture during the era of Sweden's political greatness. Later, nobles preferred the elaborate French and Italian styles (see illustration, page 43).

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Natural Color Photographs by Gustav Heurlin

SKARHULT IS ONE OF SWEDEN'S BEST PRESERVED CASTLES

A wide moat once surrounded its walls which even protected the extensive farm buildings. The huge pile, a relic of Danish days, was strongly fortified and dominated one of the few fords across a nearby river (see illustration, page 11).

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Natural Color Photograph by Gustav Heurlin

INBORN IN THE SWEDISH PEOPLE IS A LOVE OF FLOWERS AND GARDENS

Even the humblest apartment in Stockholm has its showy window-box, and each room its vase of flowers. In winter many families are served regularly by flower vendors. The Norrviken gardens near Båstad are a veritable floral exposition where examples of plants and garden architecture from many

© National Geographic Society

COLONEL LINDBERGH'S ANCESTORS DRESSED LIKE THIS

The distinguished aviator's family originally came from Skåne. Men wore embroidered shirts, often made by their fiancées. The Colonel's paternal grandfather, Ola Manson, was a member of the Swedish Parliament, and when he emigrated to the United States, changed his name to Lindbergh.

Natural Color Photographs by Gustav Heurlin

A FASHION PLATE OF BYGONE SKÅNE

Her bodice is held together by shining buttons and a chain of heavy silver. The flower design is embroidered, but that on the belt is woven. Details of some Swedish costumes vary with the parish and indicate whether the wearers are married or single.

YOUNG SWEDEN PERPETUATES VILLAGE FOLK DANCES

To tunes of fiddle music, young people don festive garb and rehearse complicated steps at Skansen, the open air museum and park near Sweden's capital. Each province once had its own dance, representing work or play—weaving, sowing, reaping, and making love.

© National Geographic Society Natural Color Photographs by Gustav Heurlin

THESE SIGHT-SEERS PLANNED THEIR TRIP MONTHS IN ADVANCE

Because of the convenient size of their native land, most Swedish youngsters learn their history and geography at first hand. Special rates by railroads and inns bring such "pilgrimages" within the purse of students and teachers. For the trek to Stockholm, these pupils wore their Värmland attire.

servants; it is the same everywhere, although different names are used. In some places it is called "looking at the stars"; at others "going out to bark." At my cousin's it was bluntly called "watering the dogs," and the young people took the opportunity to indulge in wild races around the garden. But I have seen uncles of 80, too, going out into the frosty night with their favorite dogs, without thinking of putting on an effeminate overcoat; they have kept their ancestors' toughness and hardihood.

This was in every way a cheery family, and it did one good, in the depths of the crisis, to see their comforting optimism and unflagging industry. My cousin and his wife were untiringly in harness from early in the morning; but, however busy they were, they always found time for sport with their four sturdy children.

He declared that it was "his damned duty" to keep himself in good fettle and condition, so that his eldest son might have to pay the succession duties as late as possible. Early deaths were a luxury which the owners of entailed property could no longer afford.

When he had figured out that it did not pay to rear cattle, he took to breeding horses and sheep. And when the forests were no longer worth selling on account of Russian dumping and other unfortunate circumstances, he resolutely changed his course and immediately began to build shooting-boxes and week-end cottages, which now earn him and his workmen a living.

Talented in several branches of art, he himself draws up all the plans and designs. The cottages are so pleasant and original that they made a hit at once.

His pious uncle had erected a hall for religious meetings, but these in recent times had eked out a precarious existence, with only a few old workhouse people and women squatters as congregation. Now my cousin has turned the meetings into musical evenings, at which he and his retainers practice old and new songs with such vigor and verve that the noise is heard far away across the fields.

The evenings often end in his being asked to sing a few solos. He has a good voice and an unassuming, attractive style, which make it a pleasure to listen to his singing.

It sometimes happens that a chance scientific or literary guest gives an address or reads aloud something written by himself, and it is a real delight to see the live, keen interest with which these agricultural laborers and their wives and children follow and appreciate what they hear.

The majority of them are naturally members of the district trades-unions; and the proximity of Västerås and its world-famed Asea (General Swedish Electric Company) factories means that they are filled with rather extreme radical opinions.

But this does not prevent them from discussing all kinds of topics and making music with their employer in the most unconcerned manner. Some of them asked me if I knew that it was he who had "hand-painted" the pictures which adorn the walls of the hall. They are evidently not a little proud of their energetic young count.

On my cousin's estate patriarchal tradition and the advancing flood of new ideas, and all they stand for, are about equally balanced.

WOMEN TRAINED IN POLITICS

But there is another place whose owner has flung the doors wide open to the new spirit and bidden it welcome. This property is called Fogelstad, and is owned by Miss Elizabeth Tamm, a member of Parliament, and one of the ablest and most conspicuous of our advanced women. Thanks to her extraordinary powers of organization and practical wisdom, she has been able to bring her own estate successfully through the crisis, and also to work as an agricultural politician and reformer.

Her departures in this line are most remarkable, and so is the political school for women she has established on her property, with Miss Honorine Hermelin as principal. Its object is to train women in social questions, to teach them to administer a commune and a parliament, with all the meetings and committees.

Courses are arranged, too, in psychology and history. The women learn to read the newspapers in a new way and see historical events in their proper connection, and to understand the political movements which are sweeping over the world at the moment. No party politics are carried on in that school; all individuals and opinions are studied with vivid interest.

Lecturers come to the school full of their experiences, straight from slave-trade commissions in the East or from acting as

Photograph by G. Heurlin

GUSTAVUS VASA, FATHER OF SWEDISH INDEPENDENCE, BUILT VADSTENA CASTLE

Surrounded by a wide, deep moat, and protected on all sides by ramparts and round bastions, this old fortress on Lake Vättern was designed to check attacks from the south, territory then under Danish control. It is a fine example of a fortress of a dramatic period in Swedish history.

Photograph by C. G. Rosenberg

GROTESQUE BOX HEDGES STAND LIKE GRIM SENTINELS GUARDING VRAMS-GUNNARSTORP

The Sound, which separates Denmark from Sweden, and the wooded hills provide a delightful setting for the castle, a vestige of Danish rule in Skåne. The box in the gardens, surrounding the dressed-stone-and-brick buildings of 17th-century Dutch Renaissance style, are the highest north of the Alps, with the exception of those at Nymphenburg, Munich (see Color Plate V).

Photograph from The Owner of Tosterup

THE TOWER AT TOSTERUP WAS DESIGNED FOR STAR-GAZING

It was oriented under the direction of Tycho Brahe, Sweden's 16th-century Galileo, and is out of alignment with the rest of the castle. Later this old estate came into the possession of the eminent admiral, writer, and critic, Count C. A. Ehrensvard. The library is full of his deep and witty manuscripts on politics and art and his brilliant letters and drawings. Now graceful swans float in the broad moat.

delegates at Geneva. Much attention is given to current events.

The old pupils have formed an association which every midsummer reassembles at Fogelstad for a few days' refreshing and inspiring companionship. Women from the most diverse spheres meet there—factory girls, students, farmers' wives, women lawyers and social workers, landowners' wives of noble family, and other employers. The contact between them is not the least fruitful result.

The women who attend the school are mostly Scandinavian, but now and again come visitors from far away, even from India. This enterprising and progressive little cultural center has in the eight years of its existence become known far beyond the boundaries of Sweden.

Its two founders set before them as their aim, "to make women more courageous." Their interpretation of *noblesse oblige* is, in any case, a new and living one.

ERIKSBERG CASTLE AND A SHOOT

Last on my list of samples of Swedish country seats, I will deal with one of the greatest and most magnificent, Eriksberg Castle in Södermanland (see pages 62-3).

The first day I was there a big shooting party was in progress, so that I had at once a real quintessence of the country-house atmosphere as it is when it most resembles the care-free days of long ago.

This atmosphere met me on the way, when the white-haired, bemedaled coachman confided to me how low he felt he had sunk since he had been compelled to drive one of the motorcars. Soon, he was sure, his thoroughbred carriage horses would be as useless as the gilded baroque and rococo state carriages which stood in the coach houses as relics of ancestral times. Ah, things had been different indeed in the old baron's time!

We drove past first-class outbuildings, fowl runs, and orangeries, and came to the lake, on the other side of which the château stands in a high, open position. An avenue of tall trees runs to it as straight as a rule, with water on both sides; and the

© Lund-Molle

WHITEWASH STARS FROM THE FAMILY COAT OF ARMS ADORN ITS WALLS

Krapperup Castle is now owned by the Gyllenstjerna family, whose name occurs in Hamlet as "Guildĕnstern." This remodeled 16th-century home is situated on the rocky headland of Kullen, northwest Skåne, one of the oldest estates in Sweden. The interior is filled with many art treasures.

Photograph by J. Stenhardt

THE 20TH CENTURY HAS QUIETLY PENETRATED THIS KITCHEN

Less conspicuous than the ceiling lights, however, are the linoleum floor covering and cooking range, which has been fitted on to the old-style oven. This cookroom at Olivehult, with its gleaming copper utensils and whitewashed, horizontally timbered walls, is quite typical of the Swedish country houses (see illustration, page 28).

© The Owner of Skokloster

A BATTLE RAGES ON THE TAPESTRIED GUARDROOM WALLS OF SKOKLOSTER

This is one of the celebrated Alexander tapestries, designed by Le Brun and woven and signed by Van den Hecke. The castle was so grand that Charles XI stayed in it for several days with a suite of 400 (see illustrations, pages 50, 51, and 59).

Photograph by G. Heurlin

LIVING ROOM, BEDROOM, KITCHEN—ALL IN ONE

Except for the electric light, modernism is a thing apart from this home. In the corner are the cupboardlike beds, requiring a ladder to reach the upper berth. A parlor, frequently located in another building, is reserved for entertainments and weddings. These older-type houses are numerous in Dalarna. Serene old age is a reward for the placid flow of country life.

© Ahlen and Akerlunds

ANCESTRAL PORTRAITS ON TISTAD'S WALLS DATE FROM THE ERA OF QUEEN CHRISTINA

During her recent visit to Sweden, Greta Garbo visited this stately château. Its owners are her close friends and its seclusion by woodlands afforded her a restful retreat.

steep drive up to the house is flanked by four separate annexes.

At the top of the flight of steps the cheerful, friendly hostess, the only person who had not gone out shooting, stood to receive me.

When I came from the morning fogs and November damp into the sitting room across the hall, it was as if I had walked straight into another season. The tables in the three deep window niches were full of hothouse flowers, which recalled the sunshine and southern latitude; there were flowers all over the room; and on the hearth crackled great logs, which thawed me pleasantly after my drive.

As we sat before the fire and revived old memories of our childhood and youth, my eyes flew with delighted recognition round the large rectangular room. With its heavy 17th-century furniture (in part trophies the ancestors had laid their hands on in the Thirty Years' War), it is one of the most attractive rooms I know. On one long wall hang the big portraits of the "Lady of Pinntorpa" and her husband, Baron Erik Gyllenstjerna. It was she who rebuilt the house nearly 300 years ago and gave it its present imposing aspect.

All kinds of stories are told of her stern régime, and it is declared that she still shows an interest in her life's work by putting in an appearance now and again as the castle ghost.

Between the windows are several excellent family portraits by our great 18th-century painter, Breda, and over the piano one of Rembrandt's many likenesses of Saskia. On the other walls—and, for that matter, pretty well everywhere throughout Eriksberg—hangs a really fine collection of old Italian, German, and Flemish masters—Titian, Salvator Rosa, Holbein, Breughel, Jordaens, Wouwerman, to mention a few names from among the many. An Albrecht Dürer recently "crossed the ditch," but since the others belong to the entailed property, it is hoped that they will be allowed to remain in Sweden.

ROUGH CLOTHES FOR THE SHOOTING

The time passed quickly in those pleasant surroundings; before we knew where we were it was lunch time, and the hall was filled with snorting, loud-voiced sportsmen

with red cheeks and noses. Their wet clothes had a masculine smell of powder and game, of pine woods and moss, and the older and more absurd the garments were, the more highly their owner seemed to value them.

Merry Countess X, from one of the neighboring estates, had a woolen jacket and shooting hat which had faithfully served her in rain and storm since the beginning of the century. I doubt whether any of her kitchen maids, or the poorest women on the estate, would have been willing to show herself in public in them; but she enjoyed wearing her good old togs. She was, moreover, one of the best shots in the district, so the men told me with reverently lowered voices.

To be strictly truthful, I must admit that some members of the party wore stylish and picturesque shooting kits from London's smartest tailors. Nevertheless, the old proverb, "A man is known by his clothes," counts for uncommonly little in these circles. Not even fame or money play any considerable rôle there; people are judged and esteemed by quite other standards.

Photograph by Nordiska Museet

THIS IS NOT A PERIOD RADIO, BUT AN ARTISTIC STOVE

The tile heater at Sturehov is an 18th-century design from the Rörstrand and Marieberg factories near Stockholm, and is more elaborately decorated than those in general use. Birch wood is used as fuel, and the heat circulates through channels in the tiles, heating the entire stove. Open grates are used in some of the country houses, where central heating is regarded as an effete luxury of city folk (see text, page 18).

As usual in the country in Sweden, a buffet lunch was eaten without servants. Every one helped himself from the large central table, where spirit lamps kept the dishes hot, and then sat down at the small tables scattered about the big dining room.

The food, too, had a masculine smack: every imaginable kind of herring and smoked fish, fillets and mincemeat of elk done up in cabbage, sharp ginger pears and still sharper cheese, home-made knäckebröd as thin as paper, and black spiced bread, strong brandy, and the thin light beer which is all the regulations allow in Sweden.

The whole meal was disposed of with energy and speed; and when the leader of the party blew his horn, the cheery company tumbled downstairs again and went off to the woods in a long procession of motorcars.

Only the hostess and I remained behind to go over the house. We first looked at the Flemish still-life pictures and robust 17th-century family portraits in the dining

© Aëro Materiel A. B.

ONCE A NUNNERY, SKOKLOSTER BECAME A GIFT TO A WAR HERO

Herman Wrangel, field marshal of the Thirty Years' War, was the recipient, but the present building was erected by his son, the even more famous field marshal, Karl Gustavus von Wrangel. Among its priceless collections, the author was attracted by many parchment-bound volumes which the Swedish army took as booty from Prague, and then used to pave the miry roads on their journey home. The mud stains and impressions of the cannon wheels are still visible on them (see opposite page; also, pages 46 and 59).

room; at the view down into the chapel from the organ window, and all the magnificent antique glass, china, and jeweled caskets which filled the cases along the walls.

Although many of these were historical curiosities and regular museum exhibits, none of them so strongly impressed my imagination as did a little dark, shrunken object, as hard as a stone, which lay upon a yellowed scrap of paper. On this was noted, in a graceful Old World handwriting, that it was the skin of an orange which had crowned the wedding cake at some marriage in the family in 1621. It was prettily cut in the shape of a crown, and is known to have been the first "golden apple" of the kind ever seen in our northern land.

THE FIRST BATHROOM IN SWEDEN

The first real bathroom in Sweden, too, is at Eriksberg, though our peasants have had their steam bathhouses from time immemorial. This bathroom is adorned with rich Italian stucco and sculpture of 1670. In each corner stands a finely chiseled copper bath, and in the middle is a basin with a balustrade around it. The place seems to have been designed for families of some size at a time when baths were still taken in company (see illustration, page 30).

There are heavy, ornate baroque ceilings with decoration in high relief in most of the rooms at Eriksberg, not only in the state apartments, but also the smaller bedrooms and guest rooms. And painted ceilings, too, by Ehrenstral and other Swedish masters of the 17th and 18th centuries.

The reception rooms are equipped with a quantity of old furniture and works of art, historical and cultural souvenirs and rarities. There are a tapestry and a wooden dinner service of the 16th century, Sèvres china, a complete series of portraits of the Swedish kings from Gustavus Vasa downward, several hundred exquisite old watches, and one of the most remarkable collections of coins in the North.

Perhaps the best thing of all at Eriksberg is the library on the second floor, whose rooms contain 60,000 volumes. Among its

Photograph from Amelie Posse-Brázdová

A MASSIVE CASTLE IS BUILT OF WOOD

Gripenberg was erected for Field Marshal Karl Gustavus von Wrangel, after a design of Nicodemus Tessin the Elder, the Christopher Wren of Sweden, who planned many of the country's chief buildings. The turretlike towers are reminiscent of the days when every home was fortified.

© The Owner of Skokloster

HERE SLEPT THE MASTER OF SKOKLOSTER WHEN HOME FROM THE WARS

Karl Gustavus von Wrangel, who led the Swedish armies through many campaigns in the Thirty Years' War, built the extensive château and filled it with spoils from his conquests. The walls of the bedroom are covered with tapestries woven in Holland, signed Schaep, 1634-47. Carefully preserved are the Count's bed with a red velvet baldachin, his ornamental watch, and an ebony case full of rare Swedish, Bohemian, and Venetian fancy glass, centuries old.

Photograph by Donald McLeish

A REMBRANDT MIGHT HAVE CONCEIVED THIS LIGHTING IN LEKSAND CHURCH

This largest country church in Sweden, with a seating capacity as great as a modern motion-picture theater—it will accommodate 5,000 worshipers—was built by Swedish soldiers after their return from captivity in Russia more than two centuries ago. The altar rail, where this girl is kneeling, ordinarily is used only at communions and marriages in the Swedish Lutheran churches (page 19).

treasures are some of the rarest printed works of the 15th, 16th, and 17th centuries—several unique specimens.

Among the chairs of the Gustavian and Caroline periods a kind of high-backed "Savonarola chair" stands conspicuous, with head-rests and stamped leather. It belonged to Charles VIII Knutsson Bonde, one of the ancestors of the family, who was King of Sweden in the 15th century—three different times into the bargain.

THE KING A FREQUENT GUEST

The present owner of Eriksberg, Baron Carl Gotthard Bonde, is a highly cultured and considerate man (see illustration, page 3). He contents himself with being the King's First Master of the Buck Hounds. But he is his friend at the same time. His Majesty has his own rooms at Eriksberg; it is one of the places to which he most likes to retire to shoot, play cards, and find recreation in happy family life (and in his little private hobby—embroidery).

The lady of the house is one of those people who understand how to make others happy by herself having a thoroughly good time and strenuously enjoying the blessings of this life so long as they last. Her robust and sunny personality, with its invincible aplomb and inherited authority, which some call despotism, is singularly well adapted to her 17th-century environment. One can hardly imagine any one better suited to be mistress of this, the largest estate in Sweden—60,000 acres, including tenants' holdings.

She is as expert in the musical as in the culinary field, and knows as much about flowers as about delicate hothouse fruit and breeds of poultry.

But, then, she has material of which to make something, both in and out of doors. The exterior of Eriksberg is as grand as the interior. The straw-yellow castle with its white stucco decorations and pilasters is built in the form of the letter H, with a low tower at each corner and a steeply curved roof.

The park on the southern side recalls Versailles; with its fountains, statues, clipped hedges, and cypresses, it is one of the most beautiful in Sweden. And the mistress of the house has skillfully extended it by adding flower beds in the modern style, bulb gardens, and basins in no way inferior to their older rivals.

To return to that first day of my visit to Eriksberg, the entire afternoon was not spent in going over the house. There were other things, too: a drive in the woods, where the pheasants were being killed in hundreds, and tea in the hall, where dripping-wet sportsmen moved about softly in felt slippers or simply in stocking feet, and all talked at the same time of their exploits and remarkable shots.

Then the great house became quiet for a few hours. Not a sound was heard but an occasional distant snore or a little giggling from the young people's quarters. Later began the running of water from the bath taps on various floors.

FINERY RESERVED FOR DINNER

When the dinner gong sounded for the second time at 8 a brilliant sight met the eye. All the people who in the morning had wrapped themselves up in severely practical old garments of wool, tweed, and leather, had now burst, like butterflies, from their chrysalises. I rubbed my eyes; I had some difficulty in recognizing the dazzling apparitions. Such a gathering of virile, well-groomed men and beautifully dressed, charmingly fresh and natural women it would be very hard to find outside Sweden.

The traditional smörgås-bord (hors-d'œuvres) was served in a refined and sublimated form in the upper hall, and then we went two by two into the dining room and sat down around the long table, which sparkled with blinding white damask and giant chrysanthemums in the colors of the dawn. The glass cases now had to yield up their oldest silver and most valuable china; there was, indeed, no stint.

The soup itself gave an impression of what was to come: a bouillon of all kinds of birds, but with elk's meat as deep bass in the symphony. The only spoonful I dared to taste intoxicated me like old port; I was not accustomed to such marrowy essences.

The dishes that followed worthily upheld the traditions of the place, which are as glorious in the gastronomic as in other fields of art. The green sauce with the fish and the golden one with the pheasants racked the brains of ambitious housewives and elderly gourmets. Nobody has yet succeeded in discovering their secrets, and when the cooks grow old they stay on at

Photograph by Donald McLeish

LEKSAND GIRLS LEARN EARLY HOW TO USE SPINDLE AND REEL

From the making of the thread to the last embroidered stitch on the collar, Dalarna costumes are the products of home industry. The region around Lake Siljan is the only part of Sweden where these old folk dresses are now worn regularly (see Color Plate III). The women of the district excel in lace designs and fine linen embroidery.

Eriksberg on a pension; treasured recipes are not to be circulated unnecessarily.

A vegetable was served which grows nowhere else in Sweden but at that one place. The knowledge of this made us consume this simple open-air product with greater reverence than all the early fruit and lettuces raised by the new method, with electric current in the soil.

GASTRONOMIC MARVELS EXCITE AWE

The ice-pudding was made of the thickest unwhipped cream and a mash of wild strawberries which had been stirred with sugar for four hours, and which can then be kept raw for an indefinite period. When I expressed my astonishment that modern servants could be induced to show such endurance, my hostess said that was nothing; I ought to see the Christmas porridge. In their family it had, from time immemorial, been made not of rice, but of barley, in a gigantic copper washtub. And several women, two by two, took turns in stirring it with a wooden stick for no less than ten hours on end. It was continuously diluted with rich milk, and it finally turned out a marvel, strong, rose red, and caramel scented.

I was able to confirm this on my next visit, at the New Year. For this historic porridge is somehow preserved by the long

Photograph by P. Bagge

AS ELABORATE AS A DRESDEN DRAWING ROOM IS THIS SOVDEBORG PARLOR

The intricate carved-wood baroque ceiling dates from the 17th-century days, when architects followed the German style. Later, France, Italy, and the Netherlands left their mark on Swedish country estates. Even with the widespread use of electricity, candles for such chandeliers are still made at home.

process of boiling, so that it reappears in the dining room and in the servants' hall on the eve of every feast until Canute's Day, January 13, when Christmas ends. It is served before the lutfisk instead of soup, with sugar and cream; and not only its quality, but the quantity the aristocratically slim members of the family are able to consume would astonish foreigners.

Although I have devoted some space to the pleasures of the table, it must not be thought that the material side of that shooting party was the most important. On the contrary, the tone of the company was bright and animated from the very beginning, and the longer the gathering lasted the livelier it became—as easily happens when, as in this case, every one feels in his own native element and no outsiders are present to compel reserve and reticence.

SKÅL!

As usual in Sweden, the master of the house bade the company welcome in a few cordial words, and then the host and hostess gradually drank with all the guests in turn. The guests drink with each other, too, but it would be regarded as a deadly sin if one of them should attempt to drink with his host or hostess. The custom is said to be a survival from the time when it was considered discourteous to drink the host under

Photograph by Donald McLeish

THIS FAIR MAID TAKES "TIME OUT" FOR THE PHOTOGRAPHER

Her costume is the *skedevi,* a variation of the traditional folk dress of the province of Östergötland. Near her home on Lake Vättern is the historic Vadstena Castle (see illustration, page 42).

the table; it became only the guests to befuddle themselves.

This health-drinking is a profoundly serious ceremony, however one may smile and joke the moment before and after. The men raise their glasses to the pearl button of the dress shirt, bow without rising, and stare the person they are toasting straight in the eyes; the ladies may allow themselves a vague smile as they graciously incline their heads.

Speeches are also made if there is any special occasion; though, generally speaking, this makes little appeal to the not very expansive Swedish character. As a rule, all that is done is that the man who takes the hostess in (the place of honor in Sweden is on her left) returns thanks for hospitality received in the name of all the guests. On this special occasion a member of the Royal Family was present, so it was natural that this task should fall to his lot.

When dinner is over and the liveried footmen have drawn back the chairs, the company march back two by two in a long procession through a suite of rooms to the farthest and largest drawing room, where the hostess is standing before the fire to receive thanks and have her hand kissed by the men.

In Sweden the latter do not remain in the dining room, although it may happen that a few of them steal off afterwards to some distant room to enjoy their liqueurs, brandy, and anecdotes without the fetters imposed by the presence of ladies. Our men certainly cannot be said to be great flirts or adorers of women, though they are real good fellows, excellent husbands, and reliable comrades for life.

That evening after the shoot, at any rate, there were a considerable number who did not disappear to play cards in the smoking rooms, but preferred to remain and listen to, or even take part in, the keen debate which quickly sprang up on the chance the entailed estates, and the nobility in general, had of holding out in the struggle.

A DISAPPEARING GENUS

In a book of mine just published, I had dared to question their right to existence and compared their refined species with the dinosaurs, which were condemned

SWEDEN PRESERVES THE HOME OF HER ILLUSTRIOUS NATURALIST

Carl Linnæus for more than 30 years occupied the chair of botany at Uppsala University. He built this little two-story house in 1762. In the adjacent summer building, which also served as his museum, he lectured to students and colleagues from far and near.

Photographs by Nordiska Museet

THIS ROOM IS A SHRINE TO THE BIRTH OF MODERN BOTANY

The walls of this upper-floor sitting room of Linnæus, at Hammarby, are papered with colored engravings and the original plant pictures painted by the noted botanist and his pupils. In the monumental volumes from the pen of this great scholar there appeared, for the first time, the uniform use of specific names of the different plant species.

Photograph by Atelier Jaeger

KNIGHTS AND FAIR LADIES STILL WALK IN THE HALLS OF TIDÖ CASTLE

The century of Sweden's political greatness, the seventeenth, also was the golden age of large country houses. Generals returning from the wars vied with each other in the magnificence of the castles they built. The elaborately carved doorways and doors seen here are excellent examples of Swedish art. They and the fireplace (left) bear the owner's initials and various dates, 1626 to 1652. The mantel, erected last, has different lettering, because the master had been made a count (see page 13).

© The Owner of Skokloster

HERE THE GHOSTS OF THE HEROES OF 1618 MIGHT ARM THEMSELVES

In the armory at Skokloster are about 1,200 guns of various types, and also swords, saddles, armored jerkins, cannon, and other military equipment of the Thirty Years' War, which were assembled by Karl Gustavus von Wrangel. The large drums are said to have been used as altars at services in the field during that prolonged struggle. The metal trappings for a horse lie on the top of the chest. Scholars from all over the world have come to study the historic and cultural treasures of the castle (see pages 46, 50, and 51).

by the laws of Nature to be exterminated to make way for other, fitter forms of life. "With heads waving high over the tree tops, kind and gentle, without weapons to defend themselves, when the new, aggressive, stronger, though smaller, beasts began to gnaw at their feet."

I now continued in the same strain, and the discussion came to turn on whether we can really allow ourselves the luxury of maintaining such an antediluvian caste, which still sits on its old seats and represents a form of life that of course appeals to our imagination and poetical feeling, but which is out of harmony with the time in which we live.

We certainly improve the breed of horses and dogs without our social conscience being offended, but the cultivation on the same principle of individual human beings is a matter in which we are nowadays easily attacked by scruples and sentimental appeals to our sense of justice. In this question it is considerably more difficult to maintain either the rational eugenic or the esthetic-historical standpoint.

Several of my contemporaries and the older people assailed me with vigor, holding me for a traitor to the class and race in which I had been born and brought up. And I found it really interesting and instructive to hear all the arguments they put forward to prove that the existence of their caste was justified, to explain its important functions in a modern community, and the possibility of development it could, according to them, still be considered to possess.

But many of the younger generation took my side, tacitly or with open applause. It was easy to see that these questions had already been discussed and followed with the closest attention by young people of a reflective turn of mind; it availed little to shut them up behind thick castle walls and high park railings.

AN ADVENTURE OUT OF THE PAST

On my next visit to Eriksberg I was obliged to avoid stairs as far as possible for reasons of health. As all the visitors' rooms were on the second and third floors, they had fitted out for me one of the tower rooms on the ground floor. It was, in fact, an archive room, with bookcases of massive oak fixed to the walls, though for the time it had been arranged as a cozy bedroom.

For the first day or two I did not look very closely at the backs of the volumes inside the glass cases; I took for granted that they were old deeds and other business documents relating to the property, the sort of thing which is usually kept in estate archives.

But one evening, as I sat at the dressing table, I suddenly thought that, in the flickering light of the tall candles, I could make out a name in the mirror, hand printed on one of the file covers that stood in the case behind me.

I jumped up and turned on the electric light. Was it not, in very truth, the name of Magnus Stenbock which was written there, one of our most famous generals at the end of the 17th and the beginning of the 18th century? Not till then had I discovered that there were keys in the doors of most of the cases; now my hand was drawn instinctively and irresistibly toward the lock and I opened the door.

A moment later I was sitting with the portfolio before me, taking out one epistle after another. Letters written by Stenbock as a young fiancé, burning, for all their ornamental grace; curt tidings of victory, sent during all those years in which the warrior was roaming about Europe at the head of a great army and sending private couriers to his "dearest wife and countess," who sat at home and governed their children, estate, and numerous retainers. Truly moving, magnificent in their simplicity, were the letters he wrote from captivity in Denmark, where, at last, he died. But for a few old-fashioned expressions they could just as well have been written during the World War; they gave one a strong impression of how little men have changed since his day.

As I studied those letters, I forgot both time and space—I was so absorbed in them. But I was fearfully careful to put every single sheet neatly back in its place before I took out a new one. I felt, with reverent awe, that these human and historical documents were of inestimable value, indeed irreplaceable.

When I put the portfolio back in the row, I got hold of another with Catherine the Great's name on it. I opened it and the first thing that fell into my hands was a letter in which the mighty Autocrat of All the Russians impatiently reproached

Photograph by Alfred B. Nilson

OFF TO CHURCH

On week days one would find this girl dressed in quite a different costume and working hard in the little fishing village of Kivik, Skåne, which looks out on the waters of the Baltic. The timbered brick houses with thatched roofs are distinctive of this locality.

ERIKSBERG CASTLE IS A MORE AUSTERE VERSAILLES OF SWEDEN

The estate, including tenants' holdings, comprises 60,000 acres. From the château extends a sylvan park, with fountains, statues, clipped hedges, cypresses, and flower beds (see text, page 53).

Photographs by Almberg and Preinitz

SWEDEN'S RULER OFTEN OCCUPIES THIS ROOM

The present owner of the country seat, in Södermanland, is the King's First Master of the Buck Hounds and also his personal friend. Eriksberg Castle is one of the favorite places where the King retires to shoot, play cards, find recreation in happy family life, and indulge in his little hobby—embroidery (see text, page 53).

Photograph by Almberg and Preinitz

ERIKSBERG'S SIXTY THOUSAND VOLUMES AFFORD A HISTORY OF SWEDEN

These rare printed works, which date from the eras of Gustavus Adolphus, of Shakespeare, and of George Washington, are in the main library on the second floor. The author found in the archive cases around the walls of her bedroom on the ground floor portfolios containing letters and manuscripts from the pens of early military heroes, intellectual grandees, and nearly all of the Swedish kings (see text, page 60).

our King Gustavus III for having recalled a certain envoy who had won her favor and inclination in a high degree. To judge from her peevish tone, the fellow must have been a regular *charmeur*.

There were also polished epistles from the last king of Poland, Poniatowski (Stanislaus II Augustus). And when I began to look around the shelves, I found so many names of kings and intellectual grandees from different lands and centuries that my cheeks began to glow.

Certainly, I had often heard the collections of documents at Eriksberg praised as unique. But I had taken for granted that they were kept in the well-secured library bookcases on the second floor. It had not occurred to me for a moment that I had been sleeping here right in the very thick of world history. Now, all of a sudden, it seemed to me impossible to go to bed and fall asleep and forget it all.

When I had looked at historical documents of this kind through a cold sheet of glass in public libraries and museums, they had generally left me rather indifferent and unmoved. But it was quite another thing to come into personal contact with them in this way—to get a glimpse into the most intimate destinies of these men and women while sitting in my own temporary bedroom and every now and again giving my hair an absent-minded brush.

GHOSTS IN BOOKS BANISH SLEEP

In the case between the windows practically the whole of the Swedish line of kings was represented. Gustavus Adolphus' clear, sober hand formed a characteristic contrast to the vigorous writing of Charles XII, full of willfulness and despotism. Even his crooked, ink-blurred scrawls at the age of four or five betrayed his devouring interest in military matters, both in the text and drawings.

With a little shiver I touched Gustavus Vasa's handwriting (pages 21, 42), though I could no more read his 16th-century calligraphy than the still earlier documents which I carefully extracted from the covers.

In that hour I cursed all the unnecessary things I had learned instead of that.

The hours sped by. I rose from time to time to put more wood in the stove. It grew bitterly cold towards dawn. I heard, at regular intervals, the night watchman's steps out in the courtyard and the distant striking of a clock; but I could not tear myself from the enchantment; the past had completely fascinated me.

I wandered from one bookcase to another; I felt I must get through everything in this one precious night. Perhaps this opportunity would never return; perhaps the keys would have been taken away next day and I should not make up my mind to ask for them. There seemed to be no limit to the discoveries I might make. I felt like the boy in the fairy story, who has got into the treasure chamber and cannot decide what to choose among all the golden ducats and shining jewels.

THE OLD LORDS DEFEND THEMSELVES

As I sat there, endeavoring to spell my way through ever older and more venerable manuscripts, the present gradually ceased to exist and time unrolled itself backward in an endless vista.

Some of the letter writers were my own ancestors. I remembered their faces from my grandfather's portrait gallery. Others I knew from history; but now they suddenly became close to me and warm-blooded as never before.

I saw their faces and eyes around me. My silent tower chamber was peopled with men and women long in their graves; they assembled there in Renaissance dresses of stiffest brocade, with long wigs, pigtails, and gold-laced magnificence.

And, as I watched them, it seemed to me that these imposing ladies and gentlemen began vehemently to attack and condemn our generation for the way in which their degenerate descendants had managed the good they had acquired and left behind them.

How many, in these last few years, had fallen away from their traditions and allowed mercenary-minded strangers to dismember the old estates where their fathers had lived and died! What seemed to anger them more than anything was our feeble want of conviction of our inherited right to own, to command, and to direct the destiny of our country. In this paralyzing poison they seemed to see the root and origin of all evil.

It was useless for me to defend our discredited time and explain its leveling process and various social phenomena. That was only to pour oil on the fire; and the longer it lasted, the spicier and stronger grew the formidable old fellows' words, the more violent and angry their voices. This impassioned chorus rose in a vehement crescendo and swelled into a most terrifying noise, so that at last it seemed to be the ringing of the bells in the Kingdom of Death, calling them back to the world of shadows whence they had come to visit me.

Suddenly my bewildered brain realized that it was nothing else than the first breakfast gong I had heard, and I found myself half lying on the bed with a thick portfolio in my hands. I felt miserable after a bare hour's sleep; but, nevertheless, I would not for anything have missed that vigil.

It had enabled me to learn, more palpably and vividly than by years spent in the study of stout volumes, some very essential things about the old Swedish temperament and substance, and of the predispositions and limitations from which our landed gentry had developed. And it seemed to me then that, taken all in all, there might perhaps still be room in our Lord's garden for all kinds of creatures, even for those saurians which have survived their epoch.

Notice of change of address of your NATIONAL GEOGRAPHIC MAGAZINE *should be received in the offices of the National Geographic Society by the first of the month to affect the following month's issue. For instance, if you desire the address changed for your September number, The Society should be notified of your new address not later than August first.*

Photograph by G. A. Grant, courtesy National Park Service

PURPLE SHADOWS FROM A LOW SUN PAINT MAXFIELD PARRISH SCENES IN ZION CANYON

The stupendous sandstone tower, once known as *El Gobernador,* rechristened The Great White Throne by the Mormons who settled Utah, shades from red-brown at the base to soft ivory at the summit. It rises 2,447 feet above the floor of the deep cleft cut by a river in the Kolob Plateau. Halfway up its face cottonwoods and mesquite, growing in soil lodged in a deep niche, form a green seat cushion for the chair of a Titan. A few trees bravely wave leafy banners from crannies near the top.

Photograph by G. A. Grant, courtesy National Park Service

FROM A LEVEL PLAIN THE TETONS LEAP SKYWARD

The traveler who "packs in" and camps at night along the Snake River, in the Jackson Hole country of Wyoming, wakes next morning to a scene of amazing grandeur. Grand Teton, 13,747 feet; its sister peaks to the left, Middle Teton and South Teton, slightly lower; and Mount Owen, 12,910 feet, just beyond it, thrust up abruptly through the valley floor like the jagged points of spears hurled by demons from the underworld. Across the cleft to the right towers Mount St. John.

Photograph by G. A. Grant, courtesy National Park Service

WHERE STATELY PINE TREES RUSTLE, ENTERTAINING SPEAKERS EXPLAIN TO VISITORS THE WONDERS OF YELLOWSTONE PARK

Log seats in the new amphitheater at Fishing Bridge accommodate audiences for park travel talks illustrated by motion pictures. At this place, beside Yellowstone Lake, there is a fine museum devoted mostly to birds of the area. A collection of historical relics makes up the display at Mammoth Hot Springs, and an exhibit for the study of hot springs and geysers attracts interest at Old Faithful.

Photograph by G. A. Grant, courtesy National Park Service

IN GLACIER NATIONAL PARK 27 ICE-CUT VALLEYS DEEPLY SCORE THE ROCKIES

Mile-high cliffs are common; it is as if some prehistoric monster with cruel talons had clawed the stone of the mountains. For visitors who have time, a long horseback trip to this point, Boulder Pass, near the Canadian line, offers real adventure. The canyon yawning at the left is a 3,000-foot gash leading down to

Photograph by G. A. Grant, courtesy National Park Service

THOUGH OLD FAITHFUL HAS BEEN SLOWED SOMEWHAT BY AGE, WATCHES MAY STILL BE SET BY ITS ERUPTIONS

The most famous geyser in Yellowstone Park used to spout boiling water and steam every 55 minutes, but of late the vent has become enlarged, so that the intervals between displays have increased to 63 minutes. There is no diminution of fury, however; the column of hot vapor still rises 155 feet. It is well to keep to windward when the giant puffs.

YOSEMITE FALLS SEEM A SCARFLIKE WISP TO THE RIDER ON THE GLACIER POINT TRAIL

From the rim to the meadows of the valley is a sheer drop of nearly three-quarters of a mile. The highest leaping fall in the world takes a first plunge of 1,430 feet, then tumbles in an 815-foot cascade, and finally foams over the lower fall, 320 feet. The light buff colors of the granite walls, the forested heights, and rainbow spray make a fantastic scene.

Photograph by G. A. Grant, courtesy National Park Service

UNDER PRECIPICES OF MESA VERDE ANCIENT INDIANS TOILED AT MASONRY

The circular enclosures, or *kivas*, are believed to have been ceremonial halls. Dr. A. E. Douglass, leader of the National Geographic Society Tree-Ring expeditions, proved that the construction of this Cliff Palace, near Mancos, in southwestern Colorado, dates from 1073 A. D. (see "The Secret of the Southwest Solved by Talkative Tree Rings," in the NATIONAL GEOGRAPHIC MAGAZINE for December, 1929).

Photograph by G. A. Grant, courtesy National Park Service

WHAT A BACKGROUND FOR A SNAPSHOT—YELLOWSTONE CANYON, PLAYGROUND OF RAINBOWS!

A horseback ride along the rim to Artist Point discloses a bird's-eye view of one of the most exquisite scenes in the Yellowstone National Park. The green of lodgepole pines makes a setting for cliffs of decomposed volcanic rock, shading in hue from deep vermilion through a bewildering array of pinks to brilliant orange. The roaring river drops 308 feet in its lower fall, casting a spray that glints with color. From the edge of the road where the rider is posing, the bottom of the gorge is 1,200 feet—straight down.

Photograph by G. A. Grant, courtesy National Park Service

THE COLORADO RIVER HAS CUT THROUGH ROCKS OF THREE GEOLOGIC AGES

Rising from the swirling stream to the left is the steep gorge of the earliest, or Archæan, period of the earth's making, barren of any remnants of animal life. Above it lie the teeming chapters of the Paleozoic era of "old life," of which a poet wrote "When you were a tadpole and I was a fish." The geologist would describe it under such prosaic headings as the Tonto Platform, the slopes of shale, the red walls and terraces, the white sandstone and the buff cliffs of Kaibab limestone forming the surface binding of this rocky volume of terrestrial history. Between the vast span of the Archæan and the Paleozoic lie Algonkian strata, which do not appear in this view.

Photograph by G. A. Grant, courtesy National Park Service

DEVILS TOWER, IN NORTHEAST WYOMING, WILL RING UNDER A HAMMER LIKE THE BELL IT RESEMBLES

Phonolite, geologists call the hexagonal rock pillars of which this 1,200-foot column is composed; for they resound with clear tones when struck with a hard object, and ingenious persons have played tunes on them. This natural wonder in the Black Hills area has been designated a national monument.

© Merl La Voy

A MIGHTY AVALANCHE OF SNOW AND ICE ROARS DOWN MOUNT MC KINLEY

It may have been a small shifting of a drift when it began, near the summit of the highest peak (20,270 feet) in North America, but it gathers weight and momentum as it plunges onward, flinging clouds of snow hundreds of feet into the air. Dramatic scenes like this are not rare in Mount McKinley National Park, Alaska; yet few have been photographed. Of course, any climbing party that chanced into the path of such a monster would be obliterated.

Photograph by G. A. Grant, courtesy National Park Service

ELEVEN MILES AWAY THE "MOUNTAIN THAT WAS GOD" GLEAMS IN ETHEREAL SPLENDOR

Mount Rainier National Park, known to millions who have visited the Paradise side, offers new thrills on its rather recently developed Sunrise area, where from a 6,500-foot-high plateau motorists look out over the kingdom of the peaks. On a clear day five extinct volcanoes of the Pacific Northwest—Mounts Rainier, St. Helens, Adams, Baker, and Hood—are visible from this eyrie.

Photograph by W. M. Rush

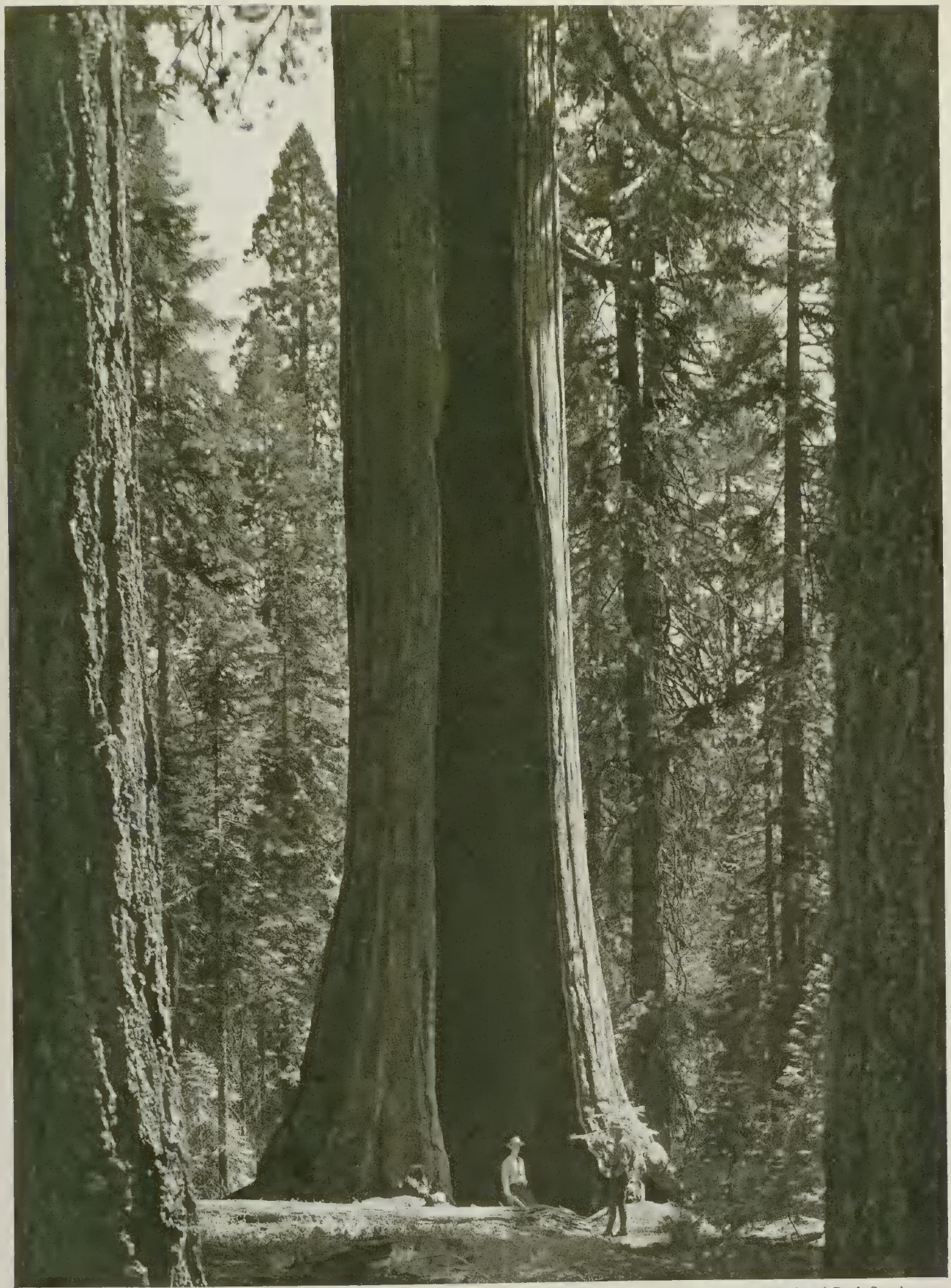
AS IN PIONEER DAYS, WILD BUFFALOES ROAM IN YELLOWSTONE NATIONAL PARK

Here, near Junction Butte, hay ranches are maintained for feeding them. The herd usually numbers about 1,000; it would be difficult to handle more than that number. Once a year the animals are rounded up in a manner reminiscent of the annual hunts by which the Indians once stocked their larders with meat for "jerking."

Photograph by G. A. Grant, courtesy National Park Service

A MUTE NATURAL CATHEDRAL REARS A THOUSAND GAUDY STEEPLES IN BRYCE CANYON

Through the ages, erosion has carved this limestone of the Utah wonderland into myriad towers, turrets, and spires as fantastic as the witch's hut of sweetmeats in the fairy tale of Hansel and Gretel. The general color is salmon pink, but it shades to reds and deep vermilion. Beyond the travelers, on the trail below Sunrise Point, are Queen's Garden and Queen's Castle.



Photograph by G. A. Grant, courtesy National Park Service

SCARRED TO THE HEART BY FIRE, THE "BIG TREE" YET LIVES

Such examples as this near the Piliars of Hercules are numerous in Sequoia National Park, far up in the Sierra Nevada. Though the inside of the trunk has been entirely eaten out by flames, the forest giant continues to bear branches and foliage and to show every sign of normal, vigorous life. It is unusual to see a photograph showing the conical tip of one of these giants and the base of another.

Photograph by W. M. Rush

WHOEVER APPROACHES THE GRIZZLY MOTHER AND CUB DOES SO AT HIS PERIL

At the feeding grounds near the Grand Canyon of the Yellowstone, these huge bears may often be seen. Even the most fearless wild-life enthusiasts let them alone. Some individuals weigh 1,000 pounds or more, though the average is considerably less.

Photograph by J. S. Dixon, courtesy National Park Service

ROCKY MOUNTAIN MULE DEER HAVE BIG EARS FOR NEWS

The animals are plentiful in Yellowstone National Park, where, of course, they are not molested by Nimrods. They attain greater stature than most other American species, an individual often weighing 300 pounds or more.

MADEIRA THE FLORESCENT

By Harriet Chalmers Adams

Author of "An Altitudinal Journey Through Portugal," "Barcelona, Pride of the Catalans," "Madrid Out-of-Doors," etc., in the National Geographic Magazine

IT WAS in midsummer that I first visited Madeira, the beautiful Portuguese island on the fringe of the eastern Atlantic. Its velvety green mountains cleft by deep ravines, its terraced hillsides brilliant with flowers and flowering vines made a lasting impression. Coming again in midwinter, it is amazing to find the same verdure, the same wealth of flora, the same warmth when the sun shines.

In December the peaks of the towering mountains, which rise like an amphitheater back of Funchal, chief city of Madeira, are, now and then, tipped with snow; but all else is vividly green, with a riot of multicolored blossoms on every terrace of this quaint old town, which climbs the hills above a sapphire sea.

Gardens are the striking feature of the Madeiran capital. Here the entire town—street, sidewalk, and garden path—is compactly paved with small, dark, basaltic stones, in greater part washed up by the restless sea. In the neatly swept gardens, hanging like balconies one above the other, the stones are laid in geometrical designs, the glistening surface of the pebbled pavement forming an effective setting for the radiant flowers of many climes which bloom here in profusion all year round (page 86).

FLORAL IMMIGRANTS THRIVE

Stiff Brazilian araucaria pines, tall Australian eucalyptus, and leafy Asiatic mango nod to palm, mimosa, and magnolia. Here the Indian fig, with its wide-spreading branches, grows beside the flamboyant of Madagascar, the coraltree of the West Indies, and the camphor-tree of Japan. A list of these floral immigrants would fill pages. They are intermingled with splendid forest trees indigenous to the island. The weird dragontree, once abundant here, still rears its ancient head.

Most effective in winter are the flowering creepers: the deep-magenta and brick-red bougainvilleas and the blazing orange bignonia, which form solid masses of color on the high walls. The flaming poinsettias and the red, pink, and white camellias grow as tall as trees. Clinging to the sheer face of the cliffs which border many of the gardens is a variety of aloe which thrusts out startling scarlet flower spikes above the blue sea.

To the gorgeous hues of the flowers add the gray and black of the rock-strewn shore, lapped by white sea foam; the deep terra cotta of the soil in the ravines which intercept the town; the pink, buff, and cream of the houses, with their green shutters and red-tiled roofs; the brilliant chrome-green of banana and sugar cane which grow in nearly every garden, and you have the "natural color picture" of Funchal.

The city presents a continuous floral show. When certain varieties cease to bloom, others burst into flower. In spring the Brazilian jacaranda proudly spreads its purplish-blue clusters above the Avenida, the giant wisteria drips lavender as it twists from tree to tree, the Pride-of-Madeira flaunts its blue beauty along the sea cliffs, and the gay azalea, dearest of all, perhaps, to the people of Funchal, blooms in many a garden.

VISITORS MOST VALUABLE "CROP"

Besides the regular liners which touch at this "flower garden of the Atlantic," many cruising ships make Madeira a port of call, bringing troops of visitors for a day ashore.

"The visitors are our most valuable crop," I heard an old resident say.

This crop is the result of intensive cultivation. Possessing a favorable location, great scenic beauty, and a remarkably equable climate, the island has much to offer (see map, page 85).

Some of its inhabitants have developed marked ability in collecting tribute from the visitor. Before boarding the launch which will convey him from ship to pier, the incoming traveler is given his first opportunity to part with his money by small merchant craft hurrying out from the shore. These boats come laden with native wares, manufactured chiefly to attract the foreigner.

The famed Madeira hand embroideries, wickerware, inlaid woodwork, walking sticks, jewelry, and feather flowers are offered for sale. There are cages filled with

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ALL ABOARD FOR A PLUNGE OF 3,000 FEET!

A broad "armchair on runners" tugs at the leash. In a moment the two attendants leap on the back and they're off down the slippery, serpentine path from Terreiro da Lucta to the capital (see text, opposite page, and illustrations, pages 86 and 106). Sight-seers hold their breath and hang on. Away goes dignity—and maybe a hat!

wild native canaries of greenish hue (see page 99). The parrots, monkeys, and cocoanuts hail from Portuguese Africa.

With the little boats come the diving boys, who beg the traveler to toss a coin into the sea (see illustration, page 84).

"A shilling, Mister! Please, a shilling!"

And down into the blue a lithe brown body follows the gleam of silver.

It is always a shilling they ask for, no matter what the ship's flag. British money is as acceptable as Portuguese, and has a fixed value on this island which owes so much to British patronage.

"OXEY-CAB, SIR?"

Once on terra firma, the newcomer is met by a throng of chauffeurs singing the praises of various motor trips, and shawled countrywomen offer for sale violets, roses, and camellias.

Automobiles, motor busses, and trucks now crowd Funchal's narrow streets, but it is the native *carro,* or sledge, drawn by a pair of patient oxen, which catches the eye (see Color Plate III, and illustration, page 87).

In one of these two-seated, curtained and canopied "oxey-cabs," which resemble big baskets on runners, he glides along the smooth, polished cobbles to the cog railway, which carries him up a steep incline to pine-clad heights 3,300 feet above the sea. At one of the mountain restaurants he lunches on a terrace overlooking the villa-strewn Funchal valley, the red-roofed town, and the scintillating expanse of ocean beyond.

Photograph by Wilhelm Tobien

FULL OF NEW WINE—THE SKINS, NOT THE MEN

Naked feet have crushed the ripe grapes, and now the must, packed in goatskins, is carried down from the hills to be poured into casks to ferment. Often the porters sing as they march in single file. Beside them troop boys bearing baskets of lunch.

A feature of the ascent is the shower of flowers tossed by blossom-laden children, who scamper after sledge and slow-moving funicular. This graceful act, unfortunately, is marred by the insistent clamor: "One penny! One penny!"

COASTING IN AN ARMCHAIR ON RUNNERS

The descent from the mountain can be made in a toboggan sledge, which offers an exciting ride. The speed of the passenger and cargo sledge is slow, but the downhill "running carro" provides real thrills (see illustration, opposite page).

This broad armchair on runners is used in descending selected routes of tilted streets. Two men hold the sledge in leash by guide ropes; as it starts down the slippery stone path they hop on to the back platform and the slide begins!

Then come dramatic flashes of rare panoramic views of town and sea, glimpses of gaudy-hued blossoms draping high, sunlit enclosures, dark-haired women and big-eyed children framed in vine-hung doorways, pedestrians flattened against the wall.

As the sledge approaches a curve, the crew jump off to guide it, with vigorous tugs, around the corner, checking the speed when the lower level is reached. It is well if the ride is not marred by the sight of a bent man straining up the steep hill with a heavy sled on head and shoulders (see page 86).

Those in search of adventure will find these running sledges on a few suburban roads so steep that the overheated runners actually smoke in the descent. But such mad dashes are prescribed only for daring souls.

If time permits there are motor trips to

Photograph by Branson De Cou from Galloway

ASSORTED SMILES FOR THE FUNNY FOREIGNERS

Only the baby regards them with serious eye. Gay and friendly, these feminine types peer over the wall of their modest dwelling in Funchal's suburbs. Gardens and pergolas fragrant with eucalyptus embellish even the homes of the poor

Photograph from Frederick Simpich

A FLASH OF SILVER AND DOWN THEY SHOOT

"A shilling, Mister! Please, a shilling!" The eager shout greets the traveler as he sails into Funchal harbor (see text, page 82). Lithe brown bodies swiftly follow the gleam of the coin. But it must be silver or gold, for these boys disdain mere coppers. Excellent swimmers all, they sometimes dive from lofty heights.

Drawn by Newman Bumstead

A TINY PORTUGUESE SPECK ON THE WORLD MAP IS TEEMING MADEIRA

Long-extinct volcanoes reared it from the depths of the Atlantic off northwest Africa. On its fertile and mountainous surface lives one of the world's densest populations—an estimated 761 persons to each of its 285 square miles. Nearly a third of the mass of humanity clusters in and about Funchal, the capital. Off at a respectful distance lie its satellites, Porto Santo and the lonely, uninhabited Desertas (see text, page 101).

be made through the island, the beauty of whose inland scenery is renowned; but the majority of visitors from the cruising ships see only the outstanding features of the port and the mountain heights above.

The sturdy country people who come to town with their wares, suitably shod for cobbled roads in soft-hued, yellow goatskin boots resembling the old cavalier pattern, are mighty burden-bearers. Children shoulder amazing weights, heavier than themselves. The manner of carrying baskets at each end of a pole borne across the shoulders, to the accompaniment of a rhythmic trot, has its counterpart in far-away Portuguese Macao, on the coast of China.*

Narrow cargo sledges, drawn by bullocks or mules, which conquer incredible grades, glide along the cobbles. The unique type of transportation and the tranquil nature of the island people make for a quiet, restful town in marked contrast to the roar of Lisbon's streets, more than 600 miles away in the motherland.

There is the tinkle of the bell on the neck of the oxen, the call of the driver as

* See "Macao, 'Land of Sweet Sadness,'" by Edgar Allen Forbes, in the National Geographic Magazine, September, 1932.

Photograph by Wilhelm Tobien

EVEN THE YOUNGSTERS CARRY CANES IN MADEIRA

When walking steep streets, scaling mountains, and packing cumbersome loads, nothing is handier than a staff. The lads' clothes are of homespun or a patchwork material; their tasseled caps have ear-flaps to be pulled down when climbing chill, cloudy heights, and their tanned feet are rarely shod. Santa Cruz pavements make a cobble checkerboard.

Photograph by David J. Martin

HIS LIFE IS FULL OF UPS AND DOWNS

Hard on the lungs and back is the handling of the running cars, which swoop down from the 3,000-foot heights of Terreiro da Lucta to near sea level in a few swift minutes (see illustration, page 82, and text, page 83). This slender youth, carrying his sledge, staggers up to the top several times a day.

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OX, MULE, OR GASOLINE POWER? TAKE YOUR CHOICE AT THIS TAXI STAND

The curious, canopied "Madeira sleigh" was born of an early English resident's necessity. The wife of an officer could not ride horseback. To travel by palanquin or hammock made her ill. So the husband built seats on a bullock-drawn sledge and thus started a style in transportation which still survives (see Color Plate III and text, page 83).

he urges the animals on, the singsong of the occasional street vender; but these are subdued notes. Even the honk of the automobile is less insistent on this peaceful isle. The nights are strangely quiet.

The sledge seems to fit into the picture and is well adapted to steep gradients and stone-armored roads. Long may it linger in Madeiran town and countryside! Our western civilization is so forceful in brushing established native customs aside. When every land on earth is like every other, there will be less incentive for travel.

PEDESTRIANS SURRENDER SIDEWALK TO AUTOMOBILES

There are already about 1,000 motor-driven vehicles in Funchal. On many of the streets the pedestrian has surrendered his right to the sidewalk to provide parking space for the motorcar.

The streets are kept remarkably clean. The entire island is practically dustless.

I think of marine islands as the proud heads and shoulders of mountains whose feet are firmly set on the ocean floor far beneath the surface of the sea. Madeira is one of these oceanic Amazons whose height from her crown, on the summit of Pico Ruivo, to her base in the briny deep south of Funchal is nearly 20,000 feet. Only about one-third of this mountain queen is visible above water, her head and shoulders, draped in a vivid emerald scarf.

The islands forming this archipelago, Madeira and Porto Santo and two uninhabited groups, are of volcanic origin. Considering the depth of the surrounding sea, and the abysmal chasms which everywhere cleave Madeira's mountainous surface, it is evident that a vast period of time must have elapsed since the beginning of the countless eruptions which went toward the making of this island. To-day no live craters exist in this group, as on the Canary and Cape Verde Islands to the south.

The Madeiras are not colonial possessions of Portugal, but constitute one of the administrative districts of the motherland, the chief authority being vested in a civil governor in Funchal appointed by the Central Government.

It requires less than half the time for a resident of Madeira to reach Lisbon by sea that it does for a Californian to journey by rail to Washington, D. C.

Much traditional lore is associated with the discovery of Madeira. Romans, Arabs, Italians, Spaniards, French, English, and Irish have all been credited as the first to glimpse this island. The most romantic of the legends concerns two English lovers, Robert Machin and Anna d'Arfet, who, in the middle of the 14th century, eloped from Bristol in a small craft bound for the coast of France. Borne south by tempestuous gales, they were blown to Madeira's eastern shore, where they landed and found sustenance in forest and stream.

One night in a storm their little boat was carried far out to sea. Anna died from the shock of this disaster and the broken-hearted Robert expired so soon thereafter that the lovers were buried in the same grave. The crew went about building another boat, and when it was finished they sailed away, homeward bound; but treacherous winds carried them to the coast of Barbary, where they were made prisoners.

Years later, a Spanish sea dog, Juan de Morales, long held captive by the Moors, was ransomed and carried the story of the discovery of Machin's Isle, related to him by fellow captives, to Portuguese seamen. In time the tale reached that great inspirer of Lusitanian exploration, Prince Henry the Navigator, who dispatched to the south a famous mariner, João Gonsalves Zarco.

When it comes to Zarco we are on firm historic ground. He fought with Prince Henry against the Moors at Ceuta. It was he who, in 1419, sailed to the island of Porto Santo, which had been discovered the year before, and across to a larger island 23 miles away, braving a dark cloud which hung over it, an evil omen to the superstitious sailors of that day.

A TOWN RECALLS THE LEGEND OF STORM-TOSSED LOVERS

The forbidding cloud proved to be vapor hanging over the mountains of a beautiful, densely wooded land. On the shore of a sheltered bay, which some claim was the very harbor where Robert and Anna disembarked, Zarco and his followers landed. Here, to-day, lies the little town of Machico, about 12 miles northeast of Funchal. If there be truth in the sad tale of the English Machin and his sweetheart, this town may commemorate his name.

Because of its forests the new land was named "Madeira," the Portuguese word for wood. Zarco was appointed governor. Fires lit back of Funchal, to rid the island of wild animals and noxious reptiles which

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Natural Color Photograph by Wilhelm Tobien

SHE CROWNS HER RADIANT COSTUME WITH A FUNNEL-SHAPED HAT

Rarely seen nowadays is this feminine folk dress, flashing amid the green sugar cane of a terraced hillside. Along with it young Miss Madeira wears the family jewels, thick-soled goatskin boots, and by her side hangs a gourd for water or wine. The boy in brown homespun grips a man-sized climbing staff and keeps his ears warm with a woolen cap. The girl's ancient, horned hat, once worn by both sexes, has been abandoned by the men.

BOUGAINVILLEA OVERFLOWS THE WALLS IN WINE-COLORED WAVES

Into the floral paradise within the gate, these urchins of Santa Cruz will lug their milk can. They serve a typical Madeiran house of two stories surrounded by a garden full of luxuriant flowers.

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Natural Color Photographs by Wilhelm Tobien

AN ISLAND-SPANNING HIGHWAY THREADS A RUGGED RAVINE

Good roads brought modern busses, but many country folk in this densely populated land of hard labor prefer to walk and save their coppers. Beyond the wayside group at Ribeira Brava, on the south coast, basks a red-roofed villa in front of which grow Madeira's small but very sweet bananas.

THE VILLA-STREWN SUBURBS OF FUNCHAL CREEP UP THE MOUNTAINSIDES

Down the steep, rocky trails and paved streets, into the heart of the capital, visitors coast at breakneck speed on greased runners. In the foreground three generations stitch embroidery (see Color Plate VI).

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Natural Color Photographs by Wilhelm Tobien

CALL AN "OXEY-CAB" AND GO SLEIGH-RIDING OVER COBBLESTONES!

As the gay, canopied passenger sledge, or *carro*, skids along at a trot, a man races beside it to throw tallowed rags under the iron-shod wooden runners while the boy guides and prods the oxen. An hour of the fun in Funchal cost the lady about 60 cents. Until a few years ago Madeira had no wheeled traffic.

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Natural Color Photograph by Wilhelm Tobien

TO FUNCHAL'S SAPPHIRE HARBOR COLUMBUS CAME WHILE HE LIVED IN THE MADEIRAS, DREAMING OF SAILING FARTHER WEST

Now, white yachts, sailing ships, liners and tramps from the Old and New Worlds dot its brilliant waters. The steep, narrow streets, their cobbles worn smooth, are bordered by high-walled tropical gardens and houses tinted in soft pastel shades. The hotels of the island, long a favorite winter resort, nestle near the sea at the left beyond the hill. In the foreground a milkman carries his cans slung from a pole. Above the girl shading her eyes in the doorway trails the purple glory of bougainvillea (see Color Plate II).

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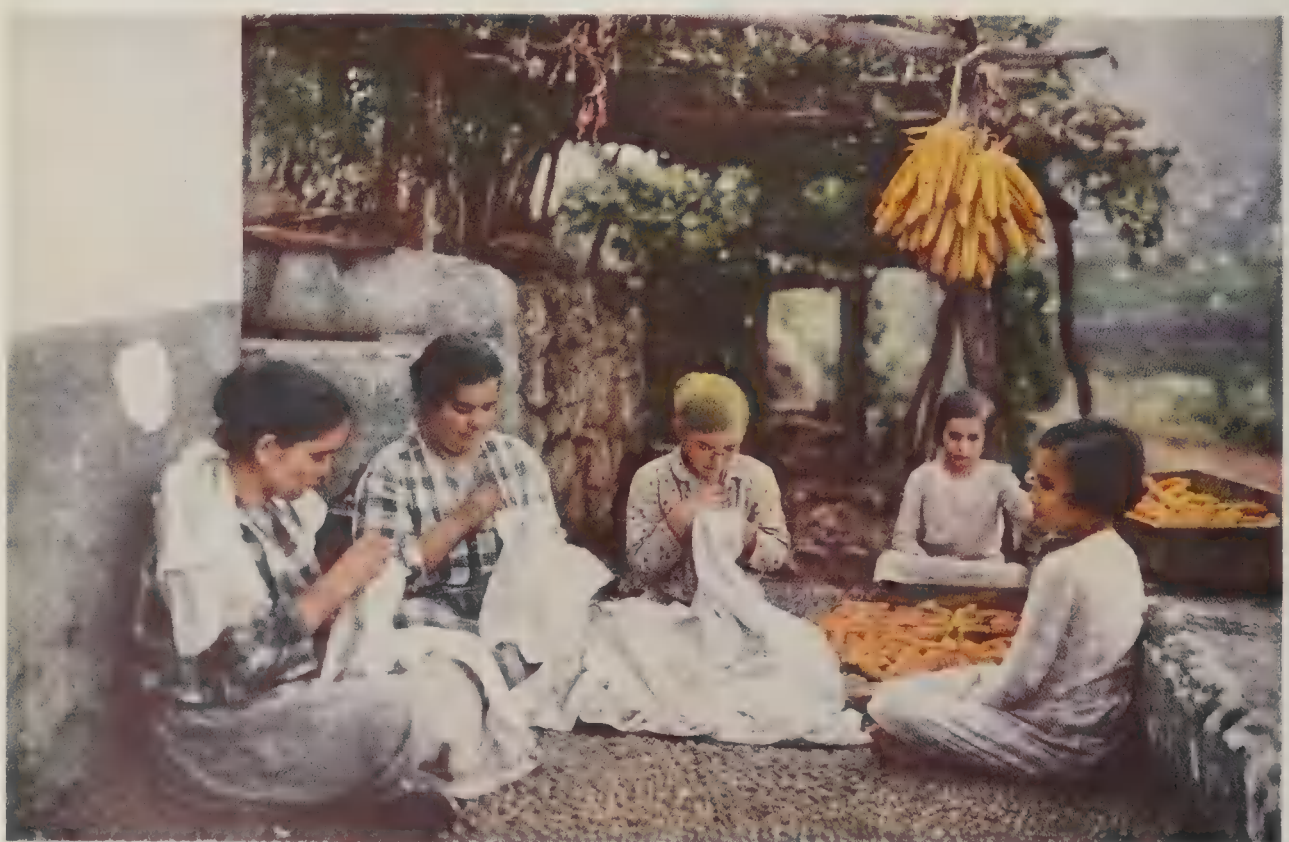
Natural Color Photograph by Wilhelm Tobien

MADEIRA'S TERRACED HILLSIDES RIVAL THE STAIRCASE FARMS OF OLD PERU

The island's hard-working peasantry have mastered "perpendicular agriculture." Above the sprawling village of São Vicente, on the scenic, precipitous northern coast, vineyards and farms rise in terraces up the green slopes. The rich volcanic soil springs to life at the touch of water brought from the rain-catching mountain tops through stone irrigating canals, miles long. Beyond lies the gleaming Atlantic. At this town terminates the paved trans-island highway from Ribeira Brava (see Color Plate II).

STONE AND THATCH MAKE A HUMBLE "HOME SWEET HOME"

This peasant of São Vicente works hard to keep his brood supplied with maize porridge, fish, vegetables, and the favorite sweet potato. Peasants usually own their vine-clad houses, walls and trees—but rarely the land. Crops are cultivated on shares, the landlord generally taking a third or half.



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MADEIRA EMBROIDERY, LIKE MADEIRA WINE, MAKES FAMOUS THIS PORTUGUESE ISLE

Busy women, squatting "tailor fashion" on the cobbles, stitch intricate patterns, which are stamped on linen by the agents of foreign firms. The art of fine needlework was introduced to the islands by an Englishwoman in the middle of the last century.

HE TAKES HIS LITTLE PIG TO MARKET ON A LEASH!

Along stone-paved highways, built for the ox sled and now adapted to the motorcar, visitors may wind through the rugged interior past cottages, villas, and clumps of reeds (left), used in basket-making. Some resort to man-borne hammocks when they explore high peaks and inaccessible gorges.

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Natural Color Photographs by Wilhelm Tobien

THE PEAKED-THATCH COTTAGE OF THE MOUNTAINS IS MOSTLY ROOF

In pleasant Camacha, Madeiran wickerwork is made from willow growing along near-by streams. Fragrant flowers, such as those in the dooryard, are borne on women's heads down the steep road to the Funchal market. Large families are the rule and children romp everywhere.

AROUND THE MODEST CHAPEL REVOLVES THE LIFE OF THE PIOUS PEASANTS

On feast day pilgrimages to church, there is much merrymaking to break the monotony of everyday toil. Led by their musician, playing his small Madeira guitar, gaily singing groups of men and women march along the road. Here an elderly milkman rests his burden on the steps and chats.

© National Geographic Society Natural Color Photograph by Wilhelm Tobien

WHERE HEAVY LOADS DO NOT MAKE HEAVY HEARTS

Up and down steep grades and across mist-enfolded mountains trudge these industrious, frugal peasants, barefoot on rough stones. The graybeard and his wife cheerfully carry their share down the long road to the capital. Now the group is homeward bound.

did not exist, raged month after month across gorge and mountain, destroying much of the virgin forest.

Sugar cane was introduced from Sicily, and to it was due Madeira's prosperity during the early years of its colonization. Negro and Moorish slaves were imported from Africa to work on the sugar plantations and to build roads and aqueducts. The stone irrigating canals, or *levadas,* extending for miles down the steep mountain sides, still render efficient service (see illustration, page 102, and Color Plate V). Without them the lower regions would be without water the greater part of the year.

Feeling the need of an aristocracy to lead the humbler colonists, representatives of Portugal's nobility were sent to Madeira, among them three young noblemen who married three of Zarco's daughters. The first children born on the island, twin boy and girl, were fittingly christened "Adam" and "Eve."

Zarco was elevated to the nobility, and governed for more than 40 years. I have seen his tomb in Santa Clara, the oldest church in Funchal; and, on heights overlooking the town, the monument erected in his memory 500 years after his landing.

WHERE COLUMBUS PONDERED GEOGRAPHIC PROBLEMS

A world-renowned figure stands out in the early history of Porto Santo and Madeira. Christopher Columbus, restlessly sailing these seas in search of information regarding the then unknown Western Ocean, came to Porto Santo. He married pretty Philippa Perestrello, the Governor's daughter. The house where they lived in Villa Baleira, the only town in Porto Santo, can still be seen.

Columbus devoted himself to chart-making, from time to time visiting Funchal to gather information. In the Madeiras, Canaries, and Azores he listened to the tale of every adventurous sailor he encountered, picked up valuable nautical hints, and pondered deeply on the drift borne islandward from the west.

After the discovery of the New World, the ports of these eastern islands knew many a sturdy caravel bound for the Indies and welcomed many a returning sail.

The tie between the English and the Portuguese dates back to 1387, when João I of Portugal married Philippa of Lancaster, daughter of John of Gaunt. This bond was strengthened by the marriage, in the 17th century, of Charles II of England to the Portuguese princess, Catherine of Braganza.

It was then that the English, loaded with privileges and exemptions, flocked to Madeira. The British "factory," combined trading and social center, was established.

Although the British factory ceased to function more than a century ago, foreign trade is still largely in British hands, there is a permanent British colony, and the majority of visitors who come for the winter months hail from the British Isles. Captain Cook was one of the early English writers on Madeira, visiting the island in the latter part of the 18th century.*

WINE MADE ECONOMIC HISTORY

Soon after the colonization of Madeira, the Malavesi vine was imported by Prince Henry from Crete, and other varieties were introduced at a later period. To-day one type of Madeira wine bears the old name, "Malvasia," or "Malmsey," famous in England when western European wines of that name were well known, and later when Madeira wines had taken their place.

Owing to wars with its neighbors, England, in the middle of the 17th century, strictly prohibited the importation of wines from France, Italy, Spain, and Portugal, at the same time decreeing that wines of Madeira and the Azores might be carried in English-built ships to England or to "any of the lands, islands, plantations, colonies, territories, or places to His Majesty belonging, in Asia, Africa, or America."

Our naval hero, John Paul Jones, was at one time master of the *Two Friends,* a Madeira wine ship. The finest wines of the island were in demand in the American Colonies. Ships from Boston, New York, Philadelphia, and Savannah, laden with pipe staves, timber, train oil, dried fish, and rice, brought back pipes of Madeira to the wealthy American merchants and planters.

To-day there are several varieties of Madeira—heavy and light, sweet and dry. The best of the seasoned dessert wines is a rich golden-brown in color, and looks and tastes much like old Spanish sherry.

In the old days wine sent from the island on a long sea voyage by sailing ship to the Tropics was found to be greatly improved

* See "The Columbus of the Pacific," by J. R. Hildebrand, in the National Geographic Magazine, January, 1927.

Photograph by Wilhelm Tobien

MODERN RADIO TOWERS TOP 300-YEAR-OLD PEAK FORT

From the commanding heights above Funchal frowns Forte do São João do Pico, built by the Spaniards during their occupancy. Below its weathered battlements wind narrow streets bordered by walled gardens and houses with old-fashioned balconies and shuttered windows.

by the heat. To-day some Madeira wines are mellowed by being kept for weeks in heated vats at a fixed temperature and are later fortified. A recent decree prohibits the exportation of wine until it is five years old.

Madeira is a small island, little more than 30 miles in length and less than half this in width; but it is so mountainous, so gashed by deep gorges and guarded by gigantic headlands, that access is difficult to certain of its sun-kissed coastal villages, cool, mist-enveloped uplands, and deep, fern-hung canyons.

Motor busses, which connect the villages on the paved highways, have made a marked change in the manner of life and outlook of the country people. Long accustomed to perilous descents afoot or by sled, they show no fear as the heavily laden bus sways around sharp curves, skirts precipitous cliffs, and lumbers down some of the steepest grades with which a car is called upon to cope.

One of the most interesting motor trips to be made from Funchal takes us up the serpentine road back of the town to the summit of the mountains. We linger at the 500-year-old church of Nossa Senhora do Monte, on a hill crest above the city. It shelters the tomb of the exiled Karl, Emperor of Austria-Hungary, who, until his death, twelve years ago, lived with his family on an estate near by.

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THUS THE FINE LADIES OF FUNCHAL ONCE WENT ABOUT TO TEA PARTIES

Nowadays the hammocks are rarely used except for exploring rough mountain country. The bearers keep in step and often break into a canter. If the passenger shows signs of falling asleep his porters talk to him constantly, for they say dead weight is harder to carry.

Photograph by Wilhelm Tobien

THE CANARY MIGHT ALSO BE CALLED THE "MADEIRA"

Cages of the feathered musicians are displayed in the Funchal market, for these birds are native to this island as well as the near-by Canary group. They are often seen flying wild in the glens. Their normal color is grayish brown, slightly varied with green, yellow, and other hues. The all-yellow bird was a product of careful breeding.

Photograph by David J. Martin

MADEIRAN BOOTS HINT OF FAR-AWAY RUSSIA

Oak now imported from New Orleans for wine casks once came from the Tsars' Baltic provinces. This casual contact may explain the island's goatskin footwear, spread out on the stones of Funchal's public square. For the shawled, kerchiefed women and swarthy men the style is exactly the same. Nowadays thick soles are cut from cast-off automobile tires, many of which once rolled on American roads.

On we climb, past Terreiro da Lucta, terminus of the cog railway, through wooded country where pines predominate, to Poiso Pass (4,553 feet). Here is one of the highland refuge houses, maintained by the Government chiefly for the use of the hardy northern peasants, who plod up steep trails in all sorts of weather, bringing eggs, poultry, and vegetables to south-coast markets.

After passing the summit, we are enveloped in mist as we cross a bleak moorland where sheep and goats graze. The winding road then drops down a ravine on the northern side of the mountains. The "view of views" is obtained when we are well down the slopes. Leaving the automobile at Ribeiro Frio, we walk about a mile over a sylvan path bordered by rhododendrons to a projecting ledge, called locally a *balcão* (balcony), on the brink of a deep canyon. Here a magnificent panorama is spread out before us.

Far below, the silver thread of a stream winds along its rocky bed. From every cleft and crevice of the cliffs above, where a foothold can be obtained, vegetation drapes the walls. Where the canyon curves out of sight loom rounded green hills dotted with white cottages overlooking the sea, which skirts the northern coast, and, across the blue waters, Madeira's satellite, the island of Porto Santo (see illustration, page 104).

For countless centuries Nature's eroding agents have been at work scooping out the deep ravines which, on every side of Madeira's jumbled mountain range, descend to the encircling sea. In their cool, ferny depths are the remains of the forest which once clothed the island: laurels, junipers, and other trees of the Temperate Zone; also various plants and ferns, some of which are peculiar to Madeira.

COLUMBUS LIVED ON PORTO SANTO

The island of Porto Santo, which we saw in the distance from the mountain balcony, is much lower and drier than Madeira. It has stretches of sandy beach which the larger island lacks, and in summer residents of Funchal brave the rough four-hour passage to Villa Baleira

to enjoy the sea bathing.

The small, short-horned sledge oxen of Funchal come from Porto Santo; so do the little white limestone pebbles which form the design on the black pavements of the Avenida Arriaga and in many of the gardens.

Porto Santo's chief interest, to me, lies in its association with the Great Admiral who gave to the Old World half a planet (see text, page 97, and illustration, page 104).

My bedroom in Funchal opens on to a garden overhanging the sea. At dawn I step out and stand under the palms by the vine-covered railing above the cliff, which is clothed with verdure to the pebbly shore.

Across the pearly waters the horizon is broken by three purple islands: the lonely, uninhabited Desertas. In the center is Deserta Grande, with Bugio and Chao on either side.

It is behind Bugio that the sun rises, shafts of radiance now piercing the gray sky. The new-born light touches the white sails of fishing boats far out from the shore. It is the beginning of another sun-drenched day.

Photograph by Wilhelm Tobien

THE DOG MARKET INTERESTS EVERYBODY BUT THE DOGS

Miscellaneous mongrels, a bit bored and sleepy, await a new master in Funchal under a sign (upper left) meaning "wholesale and retail." Thoroughbreds are rarely seen, but every peasant has his faithful dog or two. Usually one watches the owner's lunch while he works and the other guards the house.

A PLEASANT LIFE FOR THE WINTER VISITOR

On Deserta Grande there are wild goats, rabbits, and cats descended from animals brought long ago from Madeira. Colonies of sea birds frequent these shores; and in coastal caves the monk, or Mediterranean, seal is still to be found. The islands are the property of two British residents of Madeira, and sportsmen occasionally visit them to shoot the wild goats.

A second uninhabited group of islands of the archipelago, three in number, the Salvages, lie more than 180 miles from Madeira, nearer the Canaries. In summer men sail to them to slaughter the shearwater, a sea bird which nests in large numbers on these low-lying islets. The flesh, dried and salted, is eaten by the poorer classes in Madeira; the fat and down are also utilized.

From Funchal to the near-by mountain village of Camacha the ascent is precipitous. Once on the heights, we are among wide stretches of slim, planted pines, which furnish much of the fuel used in Funchal.

Photograph by A. S. Waterton

AN IRRIGATION CANAL GOES MOUNTAIN CLIMBING

Here the life-giving stream flows gently downward through a tunnel cut in the solid rock, and across a stone bridge clinging to a cliff high above thirsty, terraced farms (see Color Plate V). Some wind 50 miles or more. Water is deflected at each farm in turn for an allotted period, timed to the second.

Camacha has a grassy common unusual in Madeiran villages. Large, fragrant violets are a feature of the region.

This village is the home of the important wickerwork industry, for the bushy willow grows in the beds of near-by streams. At nearly every door men and women weave chairs, tables, and baskets.

Madeira hand embroidery has become as well known in recent years as Madeira wine. In riding through the country I have everywhere seen women, sitting in the open, industriously plying their needles at odd moments between household tasks, and girls as young as seven or eight stitching away like veterans. About 20,000 women and girls are engaged in this industry.

Life in Funchal is pleasant for the winter visitor. For some, beauty and the study of flora, customs, and language suffice; for outdoor enthusiasts there are tennis, and bathing in the sea and in sea pools built above high tide along the shore.

Some miles from Funchal, in the hills, there is a 9-hole golf course. There are the British country club; the English reading rooms; and the Casino, for dancing and games. Tunny fishing is at its best in April, May, and June.

The food at the hotels does not offer wide variety, as little is imported. Fish is a feature of the menu, one variety appearing almost daily. This is the *espada,* a scabbard-like, deep-sea fish. A familiar sight near the market is a man homeward bound with a basket of vegetables in one hand and in the other a long, black espada tied in a circle with its tail in its mouth (see illustration, opposite page).

Every New Year's Eve Funchal stages an impressive scene. On the last day of 1933, a trio of European cruising ships lay at anchor in the harbor. By 6 o'clock night had fallen, and pier, water front, and Avenida were thronged with tourists, residents, and country folk who had been flocking into town since dawn. Red and green electric lights, colors in the flag of Portugal, ran along the pier, outlined buildings, festooned trees, and extended in jeweled bands up the mountain sides. The crests of the hills were crowned with

Photograph from Charles H. Gable

IT'S EASY—EXCEPT IN A HIGH WIND

Peasant women "use their heads" to carry handmade wicker furniture down from Camacha to Funchal for sale. Long accustomed to bearing loads in this fashion, they descend the mountain at a surprising pace, often juggling five or six chairs apiece.

Photograph by Franklin Adams

THEY WERE CAUGHT WITH A LINE MORE THAN HALF A MILE LONG

Tasty, scabbardlike deep-sea fish called *espadas* (swords) are hooked at depths of 3,000 to 4,000 feet and sold cheaply here at the Funchal market. The boy has one with its tail in its mouth for easier carrying. Peasants riding back to the country are not allowed to take the fish inside the busses; so they are hung along the outside, like rows of small spare tires.

Photograph by Topical Press Agency

LIKE A HOT SLICE OF AFRICA IS DRY, SANDY PORTO SANTO

To its beaches in summer flock holiday-makers from Madeira to bathe, bask on the sand, and eat the grapes which the warm sun ripens to amazing sweetness. From the sea this satellite isle may look hilly, but actually it is much lower than its mountainous sister, Madeira.

Photograph by M. O. Perestrello e Filhos

HERE, ON THE ISLAND OF PORTO SANTO, DWELT COLUMBUS WITH HIS BRIDE

The great explorer married the daughter of its first governor, and for some time about 1479 they lived in this straggling, sun-drenched town of Villa Baleira (see text, page 97). Though tiny, the settlement exceeds in age big Funchal, on the main island of Madeira.

Photograph by M. O. Perestrello e Filhos

THIS IS NOT A FOURTH OF JULY, BUT NEW YEAR'S EVE IN FUNCHAL

Clocks strike 12 on the little island, and the city, nestling in a natural amphitheater of mountains and sea, paints the sky with dazzling streamers of fire—for this is the memorable "Night of Light" when Madeira's capital greets the birth of another year (see text, page 102). Each householder likes to set off his own fireworks, but the hotels and visiting liners in the harbor, too, add to the din and lavish display which each year attract throngs of travelers.

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HUGE TABLECLOTHS LIKE TARGETS DECK A SHOP AT THE FOOT OF THE SLIDE

A familiar flag meets the eye of Americans, weak and breathless from their headlong ride (see illustration, page 82). A sign in English urges: "Please Come Up; Pure Madeira Wine, etc., etc." Outside are spread striking samples of the island's hand embroidery. At a rival shop across the way other flags are flown and a dummy displays a Portuguese peasant girl's costume.

brilliant lights, the illumination extending to the Peace Monument, high above the town (see illustration, page 105).

The visiting ships were aglow, and every craft in the harbor, down to the smallest fishing boat, displayed its twinkling lights. It was a clear, moonlit night. The shimmering sea was calm.

Expectantly the crowd waited for the midnight hour, all faces uplifted to the surrounding hills.

As the Old Year died and the New Year was born, a fusillade of rockets shot skyward from the heights, north, east, and west of the town, and from the ships in the harbor. Soon the heavens were ablaze with iridescent showers of light, each more beautiful than the last. Golden spangles! Glittering fountains, rising, falling, disappearing! Sheets of fire, flaming, waning, vanishing! Madeira dissolved into Fairyland!

I know of no city which can excel the effect produced on this "Night of Light" in Funchal. Apart from the national love of the Portuguese for pyrotechnical displays, and the expense and effort expended, there is here the gorgeous natural setting of wide valley, sea, and encircling mountains.

It is as if the sky, which at sunset vies in coloring with the florescent gardens below, strives, on this one night in the year, to surpass them in beauty.

WORLD'S LARGEST FREE BALLOON TO EXPLORE STRATOSPHERE

A SHELTERED pocket in the Black Hills of South Dakota, eleven miles southwest of Rapid City, has been selected as the starting point for the Stratosphere Flight sponsored by the National Geographic Society and the U. S. Army Air Corps.

The ascent is to be made early in July, the date depending upon weather conditions. For the safety and full success of such flights, almost perfect weather is necessary during the time the balloon is in the air, and over the entire area above which it drifts. The balloon cannot be sent aloft until it is determined, from hundreds of telegraphic reports supplied by the Weather Bureau, covering large regions of the United States and Canada, that fine weather lies just ahead.

The location near Rapid City was decided upon after Maj. William E. Kepner, pilot for the stratosphere expedition, and Lieut. Orvil A. Anderson, alternate pilot, had flown to numerous sites in several States and had examined them carefully from the air and from the ground.

Many sites were offered The Society by public-spirited citizens in various States, and their fine coöperation is appreciated.

Records of the Black Hills site for past years show that during the period from mid-June to mid-July there are probabilities of three or four opportunities for the flight under ideal weather conditions.

INFLATION REQUIRES NINE HOURS

The site is a level, grassy meadow 600 feet square, surrounded by cliffs and hills.* In this natural amphitheater the balloon can be extended to 305 feet above the ground during inflation, yet remain protected from winds. It requires nine hours to inflate the immense bag, and the vast area of "sail" would be dangerously buffeted by even a five-mile breeze.

A good road has been built, through the coöperation of the civic leaders in Rapid City, into the isolated pocket from which the ascent will be made. Over it, and down to the grassy floor, must be trucked the huge packing case containing the balloon, the metal gondola, and five carloads of heavy steel cylinders containing hydrogen gas to furnish the lifting power for the flight.

At Akron, Ohio, the largest free balloon ever built has been finished in the scheduled time, at the factory of the Goodyear-Zeppelin Corporation. In the vast room in which it was made the windows were sealed, the air was strained through cotton flannel, and the men and women employees wore grit-free "slumber shoes" of cloth as they walked over the delicate rubber-impregnated fabric (see illustration, page 108).

A 2⅓-ACRE JIGSAW PUZZLE

Not a stitch was taken in putting together more than two-and-a-third acres of cloth. Every one of the 3,520 major pieces into which the fabric was cut, and each of the scores of smaller fragments, was carefully cemented to its next-door neighbors with rubber cement. The next step was to cover the cemented seams of this jigsaw puzzle with fabric-backed rubber tape on both sides. When these operations were completed the seams were stronger than the neighboring fabric.

More than 300 gallons of cement—the purest rubber dissolved in gasoline and benzol—were used in putting the balloon together.

Cloth for the balloon was made from specially selected cotton of long, strong fibers. It was woven in strips 42½ inches wide and 300 feet long. One hundred and thirty of these massive rolls were used for cutting out the pieces for the balloon—39,000 running feet, or more than seven-and-a-third miles of cloth!

Every square foot of the amazing acreage of cloth passed through a rubberizing machine thirty times, each time receiving a very thin coat of rubber.

METAL PUMPED FROM BRINE WELLS

At Midland, Michigan, the ball-shaped gondola has been completed by the Dow Chemical Company. It is made of light, strong Dowmetal, weighing only two-thirds as much as aluminum (see page 110). The alloy consists chiefly of magnesium, and that rare metal is extracted chemically and electrically from a "magic brine" pumped from deep wells.

The gondola was constructed by welding together eight sections of metal shaped like pieces of orange peel. The shell thickness

* See "Black Hills, Once Hunting Grounds of the Red Man," in the NATIONAL GEOGRAPHIC MAGAZINE, September, 1927.

Photograph by Edwin L. Wisherd

TWENTY-FIVE MORE PIECES THIS SIZE MAKE THE GIANT GAS BAG

This section, shaped like a piece of pie, is 42 feet across in the foreground and tapers to a point 141 feet away from the camera. More than 2⅓ acres of long-fiber cotton cloth—nearly enough to make an awning that would shelter the playing field in Yankee Stadium—was used to make the balloon skin. This cloth was impregnated with 30 applications of rubber. Because tiny particles of dust or grit might damage the fabric, the workroom is sealed, the air conditioned, and workers must wear soft moccasins.

is slightly less than the depth of two lines of type you now are reading.

At first glance the big metal ball seems to be built of steel; and it is almost as strong as though it were. But the shell alone, before the various fittings were added, weighed only 450 pounds. If it had been made of steel, it would have weighed almost a ton.

At Wright Field, Dayton, Capt. Albert W. Stevens, scientific observer for the flight, supervised the construction of instruments and of ingenious devices that will record their readings automatically, so freeing himself and Major Kepner, the pilot, for work that can be done only by hand. These instruments and those to be assembled from other coöperating sources will make up the "pay load" of apparatus weighing more than a ton, which is the reason for the stratosphere expedition. When the many strange devices are taken aloft in the gondola, they will transform it into a floating laboratory.

As Captain Stevens is one of the foremost aërial photographers of the world, he has made use of photography as a labor-saver in the stratosphere scientific work. An ingenious motor-driven train of gears—a "brain" of clockwork and electricity—is mounted on a large aërial camera, and automatically will make photographic exposures straight down, one every minute and a half. Never before has such a large camera been operated automatically.

A SCIENTIFIC RECORD ON FILMS

At the same time that the master mechanism makes exposures by the aërial camera it sets off three other small cameras inside the gondola by means of electric solenoids. These exposures are to photograph instrument dials.

When the gondola settles to earth after its twelve-hour trip into the upper atmosphere, it will contain hundreds of feet of film on which the photographic "robots" will have recorded instrument readings that would have kept half a dozen men busy. These data will be tabulated and contributed to world knowledge.

During preparation for the flight the Advisory Committee of specialists in various fields of science have held frequent meetings at the Administration Building of the National Geographic Society. Their conferences have considered the design of instruments, plans for collecting data in the upper atmosphere, and many other problems of the flight. At The Society's headquarters, too, has centered the detailed work of handling the finances of the expedition, of purchasing its equipment, and of taking steps to insure the best chances for its safety and success.

BROADCAST FROM ABOVE THE CLOUDS

In New York City, engineers of the National Broadcasting Company have designed special broadcasting and receiving sets, of minimum weight, to be carried in the gondola. For five minutes of each hour Major Kepner and Captain Stevens plan to talk by radio, reporting their progress and describing the appearance of the earth as they rise farther and farther above it. Their comments are to be picked up on the ground near by and rebroadcast over a nation-wide network of National Broadcasting stations.

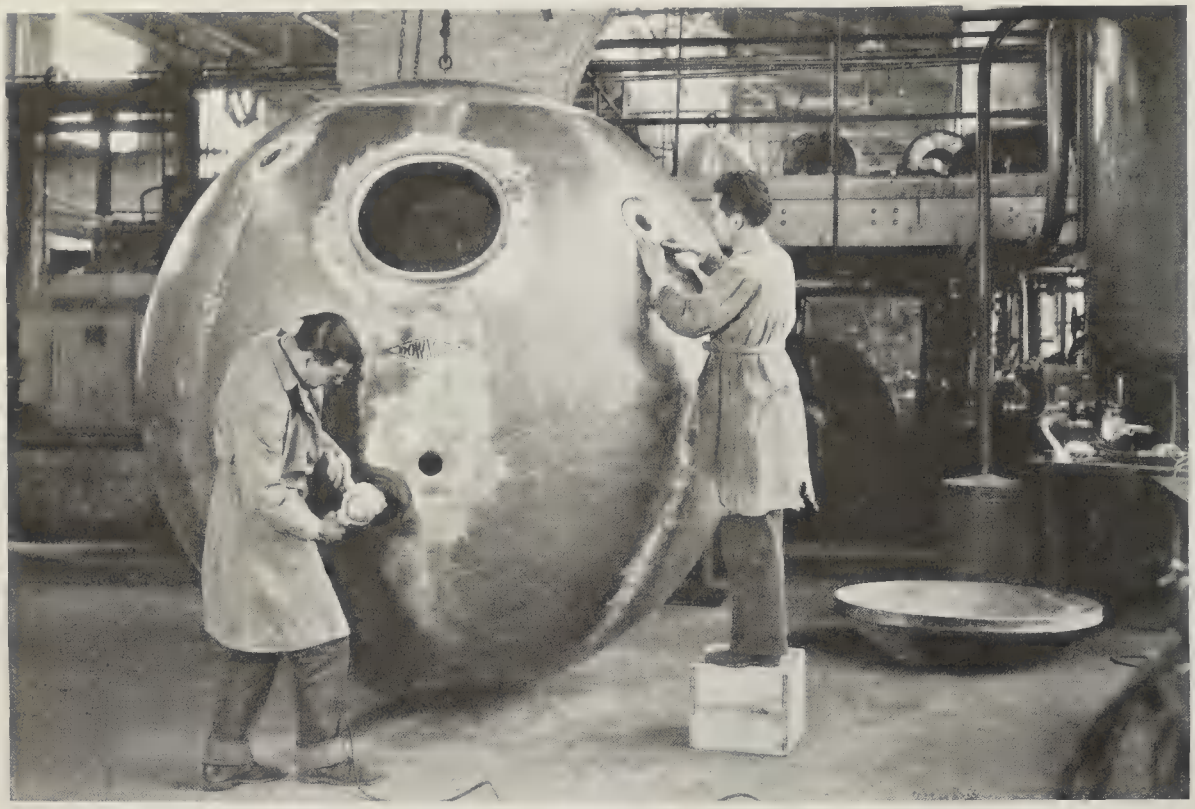
These arrangements were made to enable any of the million members of the National Geographic Society throughout the United States, near a radio set, and many members in the far places of the earth, to follow the flight in detail.

The engineers of the National Broadcasting Company also have arranged for two-way communication between the balloon and Washington. Thus officials of The Society and officers of the War Department may confer with the two balloonists at any time during their twelve hours in the air.

The stratosphere flight is being made possible by the coöperation of a group of organizations and individuals keenly interested in obtaining the fullest data obtainable of the physical and chemical conditions of the upper atmosphere. In addition to contributing the principal amount toward the expenses of the expedition from its research funds, The Society has undertaken the management of the project, and is giving the services of its staff. The Society also will publish the results of the flight in the NATIONAL GEOGRAPHIC MAGAZINE, and technical accounts will be prepared for a series of scientific monographs.

The Secretary of War, George H. Dern, through the Army Air Corps, has assigned three expert balloon officers to conduct the flight: Maj. William E. Kepner, pilot; Capt. Albert W. Stevens, observer; and Lieut. Orvil A. Anderson, alternate. The Air Corps also has made available the facilities of its admirably equipped machine shops and laboratories at Wright Field, Dayton, Ohio.

The project is deeply indebted to the Advisory Committee for the flight, appointed by President Grosvenor, of the Na-



Photograph by Edwin L. Wisherd

THE GONDOLA WAS MADE FROM CLEAR BRINE

The Dowmetal used in the car was extracted chemically from a liquid pumped out of deep wells at Midland, Michigan. The alloy consists of more than 95 per cent pure magnesium, and is one-third lighter in weight than aluminum. The sphere, slung below the balloon, will carry to the stratosphere, in addition to the two balloonists, more than a ton of scientific apparatus and 7,000 pounds of lead-dust ballast.

tional Geographic Society The chairman of the committee, Dr. Lyman J. Briggs, Director of the Bureau of Standards, and its members have given generously of their time and knowledge in shaping the plans and instruments for collection of scientific data. The members of the committee, in addition to Dr. Briggs, are:

Dr. F. V. Coville, Chairman of the Research Committee, National Geographic Society; Brig. Gen. Oscar Westover, Assistant Chief, U. S. Army Air Corps; Capt. R. S. Patton, Director, U. S. Coast and Geodetic Survey; Dr. W. F. G. Swann, Bartol Research Foundation, Franklin Institute, Swarthmore, Pennsylvania; Dr. Floyd K. Richtmyer, Department of Physics, Cornell University, and Member, National Research Council; Dr. Charles E. K. Mees, Director, Research Laboratory, Eastman Kodak Company; Mr. Willis Ray Gregg, Chief, U. S. Weather Bureau; Dr. Charles F. Marvin, and Dr. John Oliver La Gorce, Vice President, National Geographic Society.

Since the original announcement of the stratosphere flight in the April issue of the Magazine, additional contributions of funds, materials, and services have been made. The list of contributors to date is:

The National Geographic Society, The American Telephone and Telegraph Company, The National Broadcasting Company, P. G. Johnson, Capt. Albert W. Stevens, William A. M. Burden, Sherman M. Fairchild, Col. Edward A. Deeds, C. F. Kettering, The California Institute of Technology, The United Aircraft and Transport Corporation, The Sperry Gyroscope Company, The Eastman Kodak Company, The Fairchild Aviation Corporation, George D. Widener, Dr. A. Hamilton Rice, Cornelius V. Whitney, The Bell and Howell Company, The Bausch and Lomb Optical Company, The Hamilton Watch Company, The General Electric Company, The Folmer-Graflex Corporation, The University of Rochester, The Puritan Compressed Gas Corporation, The Chicago, Burlington and Quincy Railroad, The Chicago and Northwestern Railway, The Illinois Central System, and Rapid City Chamber of Commerce.

BLACKBIRDS AND ORIOLES*

By Arthur A. Allen

Professor of Ornithology at Cornell University

IT WAS my first trip to the Tropics. As we stood on the newly finished dam, Colonel Gaillard was explaining the probable extent of Gatun Lake when water should finally be admitted to the Panama Canal. But my mind was on other things.

I was an ornithologist craving bird adventure, and while I listened to the Colonel with one ear, the other received most alluring sounds from the undergrowth; and while my eyes took in the enormity of the dam I really perceived only strange shapes and bits of color flitting through the trees in the background.

The next day, as I made my way alone to the beckoning forest, from the train window I glimpsed birds I had never seen before, and yet many of them had a strangely familiar appearance.

There were hawks and swallows and woodpeckers in about the same numbers as one would see from a train window in eastern United States, but other groups flashed by in much greater variety. Instead of one species of humming bird, for example, there were apparently four or five kinds, and the same was true of the brilliant tanagers. There were many more flycatchers, and there were birds of the oriole family *(Icteridae)* nearly as large as crows.

A LESSON IN GEOGRAPHICAL DISTRIBUTION

Still other groups of birds that one could never expect to see in the United States were much in evidence. Noisy little parrakeets, for example, took the place of house sparrows, and gave the bird landscape an exotic appearance. In the forest I found warblers and vireos somewhat similar to those at home, but also many strange birds belonging to bird families I had never seen except in a museum or a zoölogical park. There were toucans with huge bills, and motmots with long racquet tails, and tree creepers, ant-thrushes, cotingas, and honey creepers that one never sees in the northern forest.

Some groups of birds that are familiar companions in our New York and New England woodlands, like the nuthatches and the chickadees, and the shrikes discussed in this article, had no counterpart in this tropical jungle; and others, like the crows and jays and even the sparrows, were rare.

Without realizing it, I was enjoying a lesson in geographical distribution that was to make clear to me, as never before, the origin of our North American bird life and the meaning of bird migration. Had I ventured into a British woodland instead of a Panama forest, the birds might have appeared equally strange to me; but even more striking than the number of new birds seen would have been the absence of representatives of so many families that are found in North and South America.

In Britain there would have been no humming birds, no tanagers, no flycatchers, as we know them; no wood warblers, and no blackbirds and orioles.

On the other hand, there would have been more sparrows and buntings, more titmice, more crows and jays, more shrikes, and more of the birds belonging to the kinglet family.

BLACKBIRDS AND ORIOLES CONFINED TO THE NEW WORLD

How, then, can we explain the absence of humming birds from the English landscape and of titmice from Panama, and the presence of both in New England? Why are blackbirds and orioles, vireos and phainopeplas, confined to the New World, while waxwings and shrikes are found on both sides of the Atlantic and Pacific Oceans?†

Evolution has taught us that all species of birds and animals were not created at the same time, and that there has been a gradual extension of range as well as an evolution of structure. It is thus not difficult to conceive that each group of birds originated in some one part of the globe in distant past ages, and in succeeding ages endeavored to populate the world.

That some should have been much more successful than others is understandable, because we know that to-day some birds are much more prolific, more aggressive, and more adaptable than others.

Compare the starling and the skylark,

* This is the eighth article, illustrated by paintings by Major Allan Brooks, in the important Geographic series describing the bird families of the United States and Canada. The ninth article, "Wild Ducks and Geese of North America," with 16 pages of paintings in color by Major Brooks, will appear in an early number.

† The bird called "blackbird" in Britain is really a thrush, closely related to our robin.

for example. Repeated attempts to introduce the skylark into North America have thus far been unsuccessful and the birds liberated have gradually disappeared. The starling, on the other hand, from an initial start in New York City in 1890, has in four decades spread to Florida, Texas, and Wisconsin, and over a great deal of this range is now one of the commonest birds.

NORTH AMERICAN BIRD LIFE HAS COME FROM TWO SOURCES

And so it is with all of our birds; some groups have never spread very far from the place of their origin, while others—the hawks and the owls, the woodpeckers, the sparrows, the thrushes, and many more—are now found over the greater part of the earth.

North America has apparently become populated with birds from two sources. The Old World, by way of Alaska, has contributed such groups as the shrikes, the chickadees, and the nuthatches, which have not yet extended their range to Central and South America. It has also contributed other families, such as the sparrows, the thrushes, the woodpeckers, and the waterfowl, which are now cosmopolitan. South America has obviously contributed the humming birds, the warblers, the vireos, and the blackbirds and orioles.

These families have not yet extended their ranges to any part of the Old World, in spite of the wealth of species to be found in the land of their origin. Of the birds discussed in this article, therefore, we have the blackbirds and orioles, the vireos and the phainopeplas, that are manifestly of New World origin with no representatives in the Old World, and the shrikes and waxwings that have come into North America from the Old World.

One reason, perhaps, why the blackbirds and vireos have not spread more rapidly is that they are migratory, and each winter retire toward the land of their ancestors. The bobolinks, for example, spend scarcely more than three months on their breeding grounds in northern United States, and the other nine on the pampas of Brazil and Argentina, and in traveling back and forth (see Color Plate VI and text, page 126).

Leaving the daisy fields of New York and New England before the middle of August, they assemble in flocks about our marshes, making their way by easy stages to the rice fields of the Southern States. About the last of October, while food is still very abundant and before the huge flocks of blackbirds that might compete with them for food have arrived from the North, they leave the United States entirely.

Flying a little east of south, they cross Cuba and Jamaica and the Caribbean Sea to Venezuela. Not content with this long flight, however, they continue in the same southeasterly direction over the llanos of Venezuela and the forests of the Amazon until they come to the wide prairies of southern Brazil and northern Argentina. What draws them to this vast area of sedge and marsh no one knows, unless it be that here the original bobolinks sprang from the ancestral blackbird stock.

MIGRATORY BIRDS DO NOT BREED ON THEIR WINTERING GROUNDS

But whether or not the pampas represent the original home of the bobolink, there they return with unfailing regularity each winter and there they spend about as much time as they do on their nesting grounds in the North, although, of course, like other birds, they do not nest at this season because they are physiologically unable to do so. So they merely travel about in small flocks until February, when they begin to feel the urge to start northward again.

Most members of the blackbird family are fine songsters, although their notes consist of relatively simple piping whistles. The simple "spring-is-here" piping of the eastern meadowlark, the clear, flutelike calls of the Baltimore oriole, "Here, here; look right here, dear," and the liquid "gurglelee" of the redwing are familiar to all Nature lovers in northeastern United States.

The more finished production of the western meadowlark and the finchlike warblings of the more southern orchard orioles are less familiar, though perhaps more to be admired. On the other hand, the rasping notes of the grackles and the shrill, squeaky whistle of the cowbird, and the squeals of the yellow-heads can scarcely be classified as music by any stretch of the imagination.

Even those species which cannot sing, however, have some method of appearing bigger and better than they really are, and thus intimidating their rivals. When the male redwing is at rest the scarlet epaulets often do not show at all. He then presents a modest appearance, with a narrow bar of buff across the wing. But when the bird

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A SOCIAL PARASITE AND A BIGAMIST

Too lazy to build nests or rear their own young, the eastern cowbirds (upper pair) play a tragic rôle in the lives of smaller birds. The female (right) has sneaked one of her large speckled eggs into a chipping sparrow's nest. Unless the foster mother builds a floor over the unwelcome present or ejects it, she will rear a ravenous cowbird almost twice her size, while her own young may be crowded out, or starved. The eastern meadowlark (lower, and flying), sweet songster of our daisy fields, has induced more than one female to become his wife, but normally he is monogamous.

takes flight the flash of red is a dazzling surprise which he apparently takes pleasure in displaying (see Color Plate IV).

During the breeding season the redwing is often seen balancing on a cat-tail or flying up into the air with the scarlet feathers standing up on end and all the feathers of its body fluffed out. At such times he gives his "gurgle-lee" song with the greatest fervor.

The various grackles also have the habit of fluffing out their feathers and spreading their wings and tail when they utter their squeaky notes. This is carried to the extreme in the cowbird, which, while spreading its wings and tail and raising its feathers as it gives forth its shrill, squeaky note, pitches forward over the branch with a disquieting resemblance to seasickness. This is a familiar sight among a company of cowbirds gathered in a tree top on a spring morning.

FOOLED BY A STUFFED FEMALE

Apparently display of plumage is purely instinctive and a natural reaction, during the nesting season, of the male to the presence of a female or, indeed, of another male in his territory.

A few years ago, in connection with the study of the cowbird made at Cornell by Dr. Friedmann, we kept a captive male in a large flying cage, and, in an effort to obtain photographs of his display, we gave him a mounted specimen of a female cowbird for company. Although the female was far from being a well-mounted specimen, so captivating was she to the male bird that he displayed for her again and again with all the ardor that he would bestow upon a live bird.

I have since repeated this experiment with other species and usually with the same result: that the male bird, during the mating period, cannot differentiate between the living and stuffed specimens.

In nest building the members of the blackbird family show as much diversity as they do in color and habitat. The bobolink builds an open nest like a sparrow's in the meadow; in a similar situation the meadowlark makes a nest of long grasses and roofs it over like an old-fashioned Dutch oven; the redwing and the yellowhead hang their nests in the reeds of marshes; the grackles build plastered nests like robins', usually in trees; the orioles build long, beautifully woven, pocketlike nests, suspended at the tip of a branch; and the cowbirds build no nest at all.

In general, the duty of building the nest, whether it be simple or elaborate, falls on the female bird. The male's duty is to sing, announcing to others of his kind that he is prepared to drive them out of his territory should they dare to intrude, and to spread the alarm at the appearance of a hawk or other enemy.

Birds feel a greater attachment to their nesting sites than to their mates, and if one mate is lost another is promptly secured.

Ordinarily the bird allows six or seven days for nest construction, three for the outside and three or four for the lining. This is approximately the time required for the yellow yolk to be deposited about the ovum in the ovary, which starts concomitantly with the building of the nest.

Just how much control the bird can consciously exercise over her egg-laying is not known, but ordinarily one egg is laid each day until the normal number of four or five is complete. Some birds lay only every other day, and some can be stimulated to lay many more than the normal number by removing the second egg as often as laid. If the nests or eggs of birds of the blackbird family are interfered with before incubation begins, they usually desert and choose other sites.

THE EGGS

The eggs of the blackbirds and orioles vary considerably, but the majority are light blue, greenish, or gray in ground color, with some irregular inklike scrawls of purple or black among the brownish spots. The eggs of the meadowlark, yellow-headed blackbird, and cowbird are rather similar, but differ from the others in being white, usually with numerous small brown spots, and very seldom with the inklike scrawls.

The incubation periods of birds of this family are in general shorter than those of other birds which lay eggs of similar size. The period of the cowbird, for example, is ten days, while those of most birds which it parasitizes, such as sparrows, warblers, and vireos, average eleven or twelve. This gives the young cowbird a day's start on the rightful young, which is a great advantage, for birds do not feed their young in rotation and make sure that each has had an equal share of the food. Instead, they feed the hungriest one first, which is the one with the longest neck and the widest mouth.

Since the young cowbird is always thus equipped, he regularly gets the lion's share.

Members of the blackbird family do not feed their young by regurgitation, as do the waxwings (page 129) and many birds, but ordinarily carry the food, consisting of insects and the like, in the bill and insert it into the gaping mouths of the youngsters. The contraction of the throat muscles in the action of swallowing is entirely automatic and dependent upon the mechanical stimulus of touching the base of the tongue.

The parent bird inserts its bill with food far enough into the throat of the young bird to produce the proper reaction. If she should not do this, the food, whether worm or grasshopper, would certainly crawl out, as many with good intentions have learned when attempting to succor an orphaned bird.

After placing the food in the throat the mother watches to see whether it has been swallowed, and, if the throat muscles do not give the proper response immediately, she reaches down and pulls out the last bug and gives it to the next youngster.

After feeding, the nest is scrupulously cleaned, and in this group of birds the feces are enclosed in a mucous sac, so that they can be carried away. The young birds are ordinarily brooded by the female; at any rate, no male bird of this family has been observed sheltering the young from heat or cold, although he may be very diligent in feeding them. After they once leave the nest, they are never brooded again by either parent, no matter how hot or cold it may be, and they never return to the nest, although they may be fed by their parents for two or even three weeks longer.

Frequently meadowlarks, redwings, and yellow-heads have second nestings, and cowbirds are known to lay eggs as late as July. The bobolinks, orioles, and grackles, however, seem to be content with one brood, though if their nests are broken up in an early stage of incubation they will often make a second attempt.

When the young are able to shift for themselves they band together into flocks of varying size, accompanied by the old birds that are through nesting. The bobolinks desert the hayfields for the edges of the marshes, and the redwings forsake the marshes for upland feeding areas, although they return to the marshland at evening to roost. Meadowlarks and orioles, as well as the yellow-heads, seldom gather in very large numbers, but the flocks of redwings and grackles sometimes contain such myriads of individuals that they are a real menace to the farmers' cherries and green corn.

The Cowbird

(Molothrus ater ater)

Every spring a male cowbird (see Color Plate I) takes his stand in the top of an oak tree across the ravine from my garden. He arrives about the first of April and is quite conspicuous until the leaves hide his perch. Whenever another flies overhead he points his bill to the sky and assumes a stiffened, dignified pose; if others alight in the tree with him he puffs out all his feathers, spreads his wings and tail, and makes a profound bow, but never tries to drive the others away, be they males or females.

A female is often seen with him, but more frequently she is observed quietly watching the phœbes that are building on the cliff by the pond, or the song sparrow or the chipping sparrow carrying straws into the spruce hedge. Oftentimes they complain of her presence with alarm cries and even fly at her as though they knew her intention to drop one of her eggs in their nests when they are completed.

For the cowbird is a social parasite which lays her eggs in the nests of other birds and foists her maternal duties on the foster parents.

If she becomes impatient and lays her egg before they have laid theirs, they often desert their first nests and start again; but if they have already laid eggs they seem to pay no attention to hers and hatch it out and rear her youngster with their own. In this they are more successful than smaller birds, the red-start, or the yellow warbler, or the red-eyed vireo that nest within the bounds of her territory (see text, page 114).

These smaller birds are not able to raise any of their own young when they have hatched a cowbird in their tiny nest. Sometimes, however, they floor over the cowbird's egg and raise their family in safety above it.

I have found nests of the yellow warbler in which three and even four cowbirds' eggs have thus been successively floored over before the warbler laid any eggs of her own. A few species have learned to throw out the cowbird's egg, but the majority accept it as one of their own and are quite as solicitous for the care of the intruder as

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A SUMMER FLAME FROM THE TROPICS IS DAPPER "LORD BALTIMORE"

Sporting the colors of Maryland's founder, the male Baltimore oriole (upper right) surveys his domain and whistles cheerily—while his lady weaves a beautiful hanging home of strings and plant fibers. Dressed richly and in perfect taste, an adult male orchard oriole (center) sings a bubbling song to his spouse (below) and to a second-year male, who matches the mother except for his black "bib." Not until the third summer can the youngster wear the gay colors of his father. The birds feed largely on insects, with a dessert of mulberries or cherries in season.

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SOME BRIGHT AND BREEZY ORIOLE COUSINS FROM THE OPEN SPACES

Bullock's oriole (upper trio) is a favorite with western bird lovers, as the Baltimore is in the East. His song may be a bit less musical, but his flashing colors are more conspicuous among the cottonwoods. Like the orchard oriole, the young male (upper right) masquerades in ladies' dress with black V-neck. Scott's oriole (lower left pair) haunts the misshapen Joshua trees of the arid Southwest and hangs its cup-shaped, fiber nest to the under sides of the yucca's stiff leaves. Perched in mesquite is a pair of hooded orioles (lower right).

for their own young, although he may have pushed out or smothered all of them.

Experiments with those species, such as wrens and robins, that probably never accept cowbirds' eggs, indicate that this ability to note differences in size or color of eggs does not extend to recognition of the young; for, if young cowbirds hatched by some other bird are placed in robins' or wrens' nests, they accept them as their own.

A few years ago, for example, I removed a young cowbird from a yellow-throated vireo's nest and placed it in a house wren's nest in my garden in which the young were approximately the same age, though far from the same size. The wrens were so diligent in bringing food that they succeeded in rearing four of their own young in addition to the cowbird. When, at the age of ten days, the cowbird was ready to leave the nest, I put him in a cage beneath the nest box and the wrens continued to feed him for twelve days longer, at which time he finally escaped.

When the young cowbird leaves the nest he develops a most insistent food call and often waylays birds other than his foster parents and successfully begs food from them. Finally he joins a flock of young house sparrows and roosts in the ivy on the house; then he joins others of his kind and makes evening flights to the marsh to roost with redwings and starlings and hundreds of cowbirds.

Thus cowbird life goes on from year to year in my garden, with nearly half of the summer resident birds rearing cowbirds instead of their own young. At first I used to remove cowbird eggs, and it still irritates me to see the scarlet tanager bring a fat cowbird to the mulberry tree, or to hear the Louisiana water-thrush making a fuss in the ravine when all she has to lose is one of these cry-baby parasites. Bird life has its ruefulness, although the birds themselves do not realize it; but it all helps to make their study fascinating.

All over United States and southern Canada, except in the southeastern corner and in the high mountains, the small birds have these cowbirds to contend with. In western United States the species is divided into several varieties, but their habits are uniformly the same and they look almost identical.

The cowbird derives its name from its habit of following cattle for the insects attracted by them or stirred up by them as they plod along, and they are often seen feeding on the animals' backs. In early accounts of prairie life they were known as "buffalo birds" for the same reason.

The parasitic habit of the American cowbirds is shared by a number of unrelated species in other parts of the world and is one of the most difficult phenomena of bird behavior to explain.

The Eastern Meadowlark

(Sturnella magna magna)

The loud, clear whistle of the meadowlark, "Spring is here," brings to my mind scenes of my boyhood in moist meadows, with pockets full of frogs and shoes caked with mud. The meadowlark has always said this to me and I suppose always will, long after my children have stopped catching frogs and tracking mud into the kitchen (see Color Plate I).

All winter the meadowlarks in small flocks gather in the old fields and barren pastures from Washington, D. C., southward to the Gulf. But as often as March comes round they start for their more northern nesting grounds. Why they should care to brave snow and ice by arriving early in March when they never start nesting until May is a mystery, but certainly they are welcome among the winter-weary folk of the North.

The males usually appear first in the spring and select certain song perches, from which they sally forth to drive others of their kind from the territory which they claim for themselves. The meadowlark is a rather shy bird, but I have often amused myself and members of my classes after an unsuccessful attempt to stalk a singing male by sitting quietly and imitating his song.

The whistle of the meadowlark is rather easy to approximate, and not much more is necessary at this season when he is "territory-mad." On quivering wings he approaches a supposed rival and circles about us, looking for the bird that dares to sing in his territory. The bird that had been so shy a few moments before now flies round us within twenty feet, and we have a wonderful opportunity to see his brilliant yellow breast with its black crescent and the conspicuous white patches in his tail.

By the middle of May one or more females have usually accepted each male's territory, the males being sometimes polygamous, and the nests are started under the

dried grasses of the previous year. Sometimes they tunnel for a foot or more under the flattened grasses before they start the nest, which usually is arched over. In this safe retreat the four or five speckled eggs are laid and are incubated by the female, but the male is quite assiduous in feeding the young.

The eastern meadowlark ranges northward into southern Canada and westward into Kansas, Iowa, and Texas, where it meets the range of the western meadowlark *(Sturnella neglecta)*, a paler species with the yellow extending onto the cheeks. The two species overlap somewhat along the borders of their ranges, but seldom intergrade or interbreed in spite of their similarity of appearance. The songs of the two species are more dissimilar than their plumages, that of the eastern species being clean-cut short whistles, while that of the western is longer, mellower, and more bubbling.

The Baltimore Oriole

(Icterus galbula)

There is a silver maple shading my drive where for the last 15 or 20 years a Baltimore oriole has hung its nest. It has not been the same pair of birds all these years, for one year both birds were taken by a screech owl and other fatalities also have occurred. Once a pair of orioles decide a tree is to their liking, and raise their young in it successfully, it is likely to be used by them or other orioles indefinitely (see Color Plate II).

Securely woven from strings and milkweed fibers, the nest hangs to the tips of the branches through the storms of winter to give mute testimony that an oriole family chose this tree for their home the preceding year, and perhaps that in itself is sufficient to encourage others to accept it.

And so each May 4 or 5 we welcome the cheery whistle of Lord Baltimore when he comes back to look over his domain. If he arrives on time we assume that all has gone well with him during the winter in Central America; but if he is late we fear that something has happened to him and that another male oriole is making up his mind to fill the vacant territory.

A few days after the male has taken up his stand, a female arrives, and his song is redoubled. A whistled imitation of it brings him like a flash to drive out the intruder. We put out short lengths of light-colored yarn or string, and in a few days Lady Baltimore is busy weaving her nest, usually starting at the top and working down and putting on all the finishing touches from the inside.

Then the eggs are laid—one each day for four or five days; and though from my window I can no longer see the female deep down in the nest, I can occasionally see the flexible pocket shake as she adjusts the eggs beneath her, and I know that in twelve days the male, too, will be absorbed in family duties from which thus far he has escaped all responsibility.

For about two weeks we can see them flying to the dark spot, now concealed by leaves, wherein the youngsters are doubling and trebling in size and budding and growing feathers, but all is relatively quiet. On a certain day, however, a change comes over the household.

We are now aware of different voices in the tree. Lord Baltimore himself has become quiet—the cares of filling four hungry mouths and the lack of necessity for defending his territory have calmed him. But we hear insistent cries from hungry youngsters. It is a sign they are nearly ready to leave the nest and have developed the food call which will enable their parents to find them after they have scattered from the nest. And what cry-babies they are from early dawn until dark!

Through June and July they all visit the mulberry tree and occasionally we hear fragmentary whistles from the male. But this does not last long, for in late summer they all moult and grow new feathers for the winter which, strangely enough, are similar to those worn during the summer. Usually, brightly colored birds such as tanagers and goldfinches wear dull feathers like the females during the winter. But the Baltimore oriole wears the same colored suit winter and summer, and to the peons of Mexico and the caballeros of Colombia and the American schoolboy he is the same gaudy fellow.

During the summer the Baltimore oriole is found from southern Canada nearly to the Gulf and west to the Rockies, and throughout its range it shows so little variation that it has never been divided into subspecies.

Orchard Oriole

(Icterus spurius)

Of less widespread distribution is the orchard oriole, which scarcely ever reaches

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GENERALS OF THE MARSHES PARADE IN GOLD BRAID OR BRILLIANT EPAULETS

Across the western plains and prairies fly the legions of the yellow-headed blackbird (upper pair and flying). His wings are marked with white chevrons and his "song" is a series of uncouth cries, like a choking spell. Below him at the left clings California's tricolored redwing, with his drab spouse. Best known of the group are the eastern redwings (bottom trio). The old veteran at the left proudly displays blazing "shoulder straps," edged with buff instead of white, while he sends forth his liquid "Ok-a-lee." His mate (center) and two-year-old son (right) wear just a hint of his insignia.

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THEIR COATS OF MANY COLORS MAY SWIFTLY CHANGE TO DEEPEST MOURNING

Iridescent greens and purples vary with the sunlight in the plumage of the grackles, and at times disappear altogether, leaving the birds a gloomy black. As if in pain, the "crow blackbird," or purple grackle (upper, with mate), grates out raucous squeaks like the creaking of a rusty wheelbarrow. Sometimes it gobbles the eggs and nestlings of smaller birds. Larger and partial to marshland are the South's boat-tailed grackles (lower). The males have a way of deserting their brownish wives until the work of raising the young is over. Where the birds are abundant, their appetite for young sprouts is the farmer's despair. Here they feast on self-sown wheat.

the Canadian border (see Color Plate II). It is most numerous in the South Central States, where it frequents orchard and shade trees and weaves a nest of freshly dried grasses, which hangs less freely than that of the Baltimore, usually resting against the branch. For some reason it seems partial to trees where kingbirds have already established themselves, and lives in friendly relations with this bird that seems to take pleasure in bullying all others.

During the winter the orchard orioles frequent the same range as the Baltimores.

Both orioles are insectivorous and very beneficial, being among the comparatively few birds that like hairy caterpillars.

Bullock's Oriole
(Icterus bullocki)

What the Baltimore oriole is to eastern United States the Bullock's oriole is to the west, the ranges of the two species overlapping only from the foothills of the Rockies to central South Dakota, Nebraska, Kansas, and Texas (see Color Plate III). In winter the Bullock's oriole retires to Mexico. In summer it ranges from the tableland of Mexico northward to southern British Columbia and Alberta.

It is fond of tall sycamores and cottonwoods, though where these are not found it may nest in low willows, especially along irrigation ditches or streams.

The song and call notes, the nests and eggs are scarcely distinguishable from those of the Baltimore oriole, to which it is closely related.

After the breeding season the bird, like all other birds, changes all its feathers. The new plumage is similar to that shown in Plate III, except that most of the feathers are edged with grayish or whitish, causing the birds to appear much duller. As spring advances, these gray tips wear off and the bird appears to become much brighter. This masking of the bright colors during the winter and brightening the plumage by feather-wear occurs in all the species of orioles and blackbirds and, indeed, is quite widespread among all birds; much more so, in fact, than is an actual renewal of feathers in the spring.

The Hooded Oriole
(Icterus cucullatus)

The hooded oriole ranges through the chaparral and cottonwoods of southwestern New Mexico, southern Arizona, and southwestern California (see Color Plate III).

During the winter these brilliant birds retire into Mexico, but by the first of April they are back in their old haunts and ready once more to hang their beautiful cuplike nest to the edge of a palm leaf or a yucca, or in the upper branches of a cottonwood.

The Scott's Oriole
(Icterus parisorum)

In the semiarid regions of our Southwest this handsome lemon-yellow and black oriole is particularly welcome (see Color Plate III). Of active disposition and often making long flights from one clump of yuccas to the next, his flash of color gives many a thrill to the traveler. His high, clear whistled song is somewhat suggestive of the western meadowlark, and while it has not the wide range and throaty quality of the meadowlark, it has perhaps greater vivacity. The female Scott's oriole, too, in her plain grayish brown and yellow, is known to sing nearly as well as the male, though not so loud nor so prolonged a song.

During the winter months the Scott's oriole retires into Mexico, but comes back again the following April to remain until August or September.

The Eastern Redwing
(Agelaius phoeniceus phoeniceus)

Each spring for the past twenty years it has been my privilege to introduce a group of students to the bird life of eastern United States. Most of them have never before ventured near the marshes, thinking of them only as places to be shunned.

It is interesting to watch their reactions when a redwing leaves the cat-tail where he has been swinging and floats off towards a female hidden in the tangle of sedges (see Color Plate IV). All of a sudden he is transformed from an ordinary little blackbird into a ball of fire, his scarlet epaulets ablaze in the sunlight—no longer a bird, but a message from the genie of the marsh. After that even the most timid member of the class must explore all the marshland for other surprises.

Early in March the redwings come back from the Southern States, where they have been spending the winter, the males sometimes two weeks ahead of the streaked females and the old birds ahead of the immature males, which can be recognized by their orange shoulders. At first they travel in flocks, spending the days on the uplands and the nights in the marshes, but when the summer resident males arrive in late

March they select their territories, and will be found in the marsh all day long.

Nesting, however, does not begin until about the middle of April, and is not in full swing until the middle or last of May. Even at this time immature females are still arriving from the South, and sometimes they settle down in the territories of mated pairs, for redwings are sometimes polygamous.

A large percentage of the early nests are capsized by the rapidly growing vegetation to which one side of the nest may be fastened. Many a time I have found nests tipped on one side, and only a single half-grown young remaining to give mute evidence of what must have become of his unfortunate nest-mates. Later nests and second-brood nests are usually safely suspended entirely in the growing vegetation.

By the last of June the young birds are gathering in flocks and moving around, sometimes accompanied by a few old males, though the majority of old birds are still busy with their second broods. The immature birds, even the males, resemble the females in their streaked gray and black plumage; but before fall they shed all these feathers, and then the young males resemble more the old males in winter plumage, except that their shoulders are orange instead of red and the black feathers are much more broadly edged with brown.

There is no spring moult, but the brown edges wear off completely by March, so as to produce the familiar coal-black bird as we know it best.

The redwing is found from the Atlantic to the Pacific and from the Gulf of Mexico to Alaska, but in various parts of its range it differs somewhat in size and proportions, especially of its bill and wing, so that the species has been divided into fourteen different subspecies.

The Tricolored Redwing

(Agelaius tricolor)

Just what happened to separate the redwings of the San Joaquin and Sacramento Valleys of California and Oregon from the parent stock and make them uniformly different we will probably never know. At the present time, however, the males show a clear white edging to their scarlet shoulders, their bills are more slender, and their females are uniformly darker. Their voices, too, have changed so as to lose some of the liquid quality of the Eastern redwing (see Color Plate IV).

In other respects, however, the habits and appearance of the tricolored redwing are essentially the same as those of the other redwings.

The Yellow-Headed Blackbird

(Xanthocephalus xanthocephalus)

This denizen of the marshes helps make the waste areas attractive, though I must admit he can lay no claims to being a musician (see Color Plate IV). What he lacks in musical ability, however, he makes up in effort, puffing out his throat and spreading his wings and tail as he balances on a reed and gives vent to a song that sounds more like "the drawl of a discontented hen" than that of many of his clear-voiced relatives.

In his other habits, however, he is much like the redwing, hanging his nest in the reeds of the marshes, gathering in large flocks after the nesting season, moving to the uplands to feed on grain and weed seed, and returning at evening to the roosting place in the marshes.

During the summer the yellow-heads are found from Mexico north to central Manitoba and Mackenzie, but are practically absent east of the Mississippi. In winter they retire for the most part into Mexico.

The Purple Grackle

(Quiscalus quiscula quiscula)

Crow blackbirds we called them as youngsters, and I can never forget the wonder of it when once at close range in full sunlight I saw one and discovered that he was not black like a piece of coal, but wonderfully and iridescently purple and green and bronze; and then as he turned and the sun struck him at a different angle he was just a plain blackbird once more (see Color Plate V). Another discovery was his yellow eye, which looked so pale in the sunlight as to be almost white; and then, when the pair of birds flew and the male held his long tail half spread towards the tip and folded so as to appear like the keel of a boat, I had still another surprise.

Every fall long files of crow blackbirds flew southward over the city—sometimes only 50 or 75 birds wide, but the flocks were possibly a mile long. People complained then as now of the noisy roosts where the birds congregated by the tens of thousands before moving southward to the Southern States for the winter.

Every March, however, we were glad to have the "blackbirds" come back and we

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"BOB O' LINCOLN" TRAVELS IN DISGUISE AND UNDER ASSUMED NAMES

To the rollicking banjo songs of the "bridegroom" in his black, white, and buff "wedding dress," the bobolinks (upper) nest in northern meadows. Then the male dons a dull suit for the flight of nearly 5,000 miles to the winter home south of the Amazon. In southern States farmers call them "rice-birds" and many are shot as pillagers. Others are eaten as "butter-birds" in Jamaica. A handsome westerner is Brewer's blackbird (right center pair). The rusty blackbirds (lower trio) vary from the greenish black of the pair at the left in summer to the rusty brown of the young deb in her fall frock (lower right).

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SONGBIRDS ALL—BUT SOME ARE HOOK-BEAKED KILLERS!

From the Old World immigrated the shrikes, or "butcher birds" (lower trio), which impale their prey on thorns and combine such predatory habits with a surprising ability to sing. Holding a field mouse victim is a young northern shrike with adult above. At the left is the smaller loggerhead. Although related to them, the waxwings (upper right trio) have straight beaks and are gentle eaters of berries, insects, and fruit. The largest is the Bohemian, and above him are cedar waxwings (young left, adult male right). The Southwest's phainopepla, or silky flycatcher, eating peppertree berries, builds the nest for his somber, gadabout wife and helps to hatch the eggs.

watched them carry dry crusts to the water and soak them before trying to eat them. Late in April we watched them carrying grasses and rags and bills full of wet mud into the tops of the Norway spruces, where they built nests like those of large robins, with an outer layer of coarse materials, a middle layer of mud, and a lining of grasses.

How we boys prized those large greenish-white eggs with their varied scrawls of dark brown and black! No two of them were exactly alike and we had great times bartering with each other, because this bird was not protected by law and we felt then that we had a perfect right to all the eggs we could find. Thus does lack of legal protection stigmatize any species.

These were the so-called bronzed grackles, found west of the Alleghanies. All those crow blackbirds that breed between the Rockies and the Alleghanies and north to the Great Slave Lake, and south to Georgia, are now recognized as belonging to this subspecies described as the bronzed grackle (*Q. q. aeneus*), while those east of the Alleghanies from southern New England to northern Georgia are the purple grackle.

The Boat-Tailed Grackle

(Cassidix mexicanus major)

One familiar with the purple grackle will immediately recognize the boat-tail as a larger edition of the same bird unless perchance he sees the female first (see Color Plate V). In her brown plumage she might be very puzzling; but the males of the two species are quite alike except that the boat-tail is some four inches longer.

The boat-tails are partial to water and may often be seen wading clear up to their breasts in the shallows, snatching aquatic insects, scuds, or little fish. They feed in small flocks, even during the nesting season, and, for some reason, the number of males seems always to outnumber the females. Sometimes they nest in the saw grass like redwings, sometimes in the willows among the herons, and again they may conceal their nests in the curtains of Spanish moss hanging from cypress trees.

This grackle is found in the South Atlantic and Gulf States, north to Chesapeake Bay and west to Texas.

The Bobolink

(Dolichonyx oryzivorus)

In this family of orioles and blackbirds the bobolink is so different that he has been placed in a genus by himself, and some would no doubt place him in a different family (see Color Plate VI).

His bill is more sparrowlike than the others except the cowbird; his female is decidedly sparrowlike in her coloration and nesting habits; and his species is different from all other blackbirds in having pointed tail feathers, the reason for which has never been satisfactorily explained.

Beside this, the fact that most birds are colored lighter below than above, while the bobolink is just the reverse, and the fact that his song, given on the wing, has neither oriole nor blackbird quality, give us a peculiar sort of a bird.

The bobolink spends the winter south of the Tropic of Capricorn, in southern Brazil and northern Argentina, nearly 5,000 miles south of his breeding grounds, in the northern United States and southern Canada (see text, page 112).

The bobolink travels farther than any member of its family. His migration exceeds the distance traveled by the meadowlarks, cowbirds, and the various blackbirds, which merely retire to the Southern States or northern Mexico, by several thousand miles; and exceeds even that of the orioles, which go to central and northern South America, by over a thousand miles.

In spite of the distance traveled, the bobolinks return with great regularity to their nesting grounds. In comparatively recent years the bobolink has extended its range to eastern Washington and British Columbia, and these birds are said to migrate eastward in the fall, so as to leave the United States by way of Florida or the Gulf coast.

The bobolinks' nest is difficult to find in the hayfield, because they prefer to place their inconspicuous cup of grasses in a little depression in the ground amongst dense grass or clover and they never fly directly to it. The gray eggs heavily blotched with reddish brown are likewise quite inconspicuous, and the yellowish brown young, resembling the female, match well the dead grasses covering the ground.

During the summer they feed almost entirely upon insects destructive to the meadows and gardens, such as grasshoppers and army worms, and are therefore among our most beneficial birds.

Before the bobolinks leave the fields and marshes of northern United States, they change all their feathers, and the new

feathers of the males resemble very closely those of the females. With most birds, including the other members of the blackbird family, this complete post-nuptial moult is sufficient for the year, but the bobolinks change all their feathers again in the spring, so as to become bright once more.

The Brewer's Blackbird
(Euphagus cyanocephalus)

Out where the real West begins, the Brewer blackbird takes the place of the bronzed grackle both in appearance and habits (see Color Plate VI). It has the same iridescent black plumage and pale yellow eye, and the same habit of walking about lawns with wings slightly drooped, and the same sort of rusty, squeaky notes. It is a decidedly smaller bird, however, and the female is much grayer, more the color of a female cowbird, though its bill is longer and more slender. About the ranches and even in towns it is a familiar back-yard bird and is even more given to lording it over the English sparrows and poultry than the grackle of the East.

It nests in small colonies, usually in a thick tree, but sometimes in bushes about marshes and on the outskirts of the colonies of yellow-heads or redwings. With these birds it associates often in large flocks, after the nesting season is over, and then may do considerable damage in grain fields.

Brewer's blackbird breeds in the western United States, north to southern Canada, and east to Texas, Kansas, and Minnesota. It winters over most of this range and south to Guatemala.

The Rusty Blackbird
(Euphagus carolinus)

During the summer the rusty blackbirds are confined to the boreal zones, and though found in western Canada as well as eastern, they begin where the Brewer's leave off and extend well up into Alaska (see Color Plate VI). When migrating they swing eastward and spend the winter mainly south of the Ohio and Delaware Valleys to the Gulf coast, and only occasionally are found within the range of the Brewer's blackbird.

In fall and winter the edges of the feathers are margined with brown, those of the young females so widely as to make them look brown like a sparrow. But these edges all wear off during the winter, leaving the males blue-black and the females almost as gray as catbirds.

When frightened from some woodland pool where they have been feeding, the whole flock rises as a body into the trees and almost immediately starts a concert of gurgles and squeaks that is interesting if not musical.

The Cedar Waxwing
(Bombycilla cedrorum)

The waxwing family contains but three species, which is quite unusual for a group that is so distinctive in appearance and has such a wide distribution. One species, the Japanese waxwing, is confined to eastern Asia; another species, the cedar waxwing, is confined to United States and southern Canada; and the third species, the Bohemian waxwing, is found almost throughout the Northern Hemisphere, though it is rare in eastern United States and also west of the Rockies (see Color Plate VII).

Assuming that the waxwings came originally from the Old World, the cedar waxwing has done a good job of colonizing North America, for it now breeds throughout southern Canada and most of the United States except California.

In migration, however, the species seems not to know what to do and is very erratic. Some years large numbers winter throughout the Northern States and the next winter there may be none over this area, but they will swing south into Mexico and even to Panama.

Usually they congregate in the Southern States wherever dried berries are abundant and migrate northward in apple-blossom time in large numbers. At this season they may be seen filling their throats with petals as few other birds do, or they find trees infested with cankerworms or elm-leaf beetles of which they seem to be very fond.

Their liking for fruit has given them the name of cherry bird in farming communities, and it is no uncommon sight to see a row of waxwings on a branch where only the outermost can reach the fruit, passing the cherry or mulberry from one to the next until one swallows it or passes it back. Their smart crests, well-groomed silky plumage, the yellow bands on their tails, and the "sealing-wax" tips to their secondaries make them favorites everywhere.

Waxwings are late nesters, seldom starting before the middle of June and continuing into September, making rather untidy

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WELL CAMOUFLAGED ARE THE VIREOS, WHOSE NAME MEANS "I AM GREEN"

They all build pendent nests, as do the orioles. Tireless singers, some repeat the same musical phrase over and over, as many as 4,000 times a day. At the left (top to bottom) are the white-eyed vireo, which volubly scolds intruders; the West's least vireo; the warbling vireo, whose song ripples up to a marked crescendo; and the red-eyed vireo, or "preacher-bird," whose reiterated phrases suggest the robin's carol. At the right (top to bottom) are Hutton's vireo of California; the yellow-throated vireo; and the blue-headed, or solitary vireo, a wild, sweet, woodland singer of the northeastern United States and Canada.

nests of grasses and wooly materials in tall bushes or in low horizontal branches of thickly leaved trees.

They feed their young, by regurgitation, a mixture of insects and berries, usually bringing back enough for the whole family in their distended throats. They are not at all shy, but often permit close approach while they are feeding their young.

If you have a mulberry tree in your garden you may expect waxwing visitors from the time the fruit begins to turn red until it is entirely gone. This will attract birds of many species all summer and may at the same time save the cultivated fruit trees from the birds.

The Bohemian Waxwing

(Bombycilla garrula pallidiceps)

This is the larger cousin of the cedar waxwing, but is very similar to it in habits (see Color Plate VII). It nests in the Canadian Northwest from southern Alberta to Alaska, and in winter wanders irregularly southward and eastward, often joining bands of cedar waxwings.

The Phainopepla

(Phainopepla nitens lepida)

The phainopeplas, or silky flycatchers, as they are called, belong to another strictly New World family numbering only four species (see Color Plate VII). They are rather intermediate between the waxwings and the vireos.

In habits they are like the flycatchers, perching on exposed branches and darting out at passing insects. They undoubtedly had their origin in the New World Tropics, and only one species, the phainopepla, has extended its range to include the United States, where it is now resident from western Texas to California.

The phainopepla is one of the few birds in which the sex duties seem to be reversed. The males are often seen building the nest and even incubating the eggs, while the females seem unconcerned until after the eggs are hatched, when both help feed the young.

The Northern Shrike

(Lanius borealis)

There are more than 90 species and subspecies of true shrikes in the Old World, but only two have become established in the New World, although these two have split up into eight subspecies (see Color Plate VII).

If one examined only the bills of the various shrikes he might think they belonged to the hawk family, so raptorial are they in appearance. One glance at their ordinary perching feet, however, will convince anyone at all familiar with birds that shrikes and hawks are not related, for all the hawks have very strong feet, with sharp, curved talons that are used in catching their prey, while the shrikes depend entirely upon their bills.

In spite of their predacious habits, the shrikes are songbirds of no mean ability, and during March, while still on their winter quarters, they may sometimes be heard singing much like a catbird. During the summer they move to northern Canada.

They are often called butcher birds because of the strange habit of impaling their prey of large insects, small birds, or mice on thorns for future use.

A few winters ago a northern shrike, attracted by the many birds at the feeding station, took up his abode in my garden, and I had frequent opportunity to watch his method of capturing sparrows. Instead of seizing his prey in his claws, he depended entirely upon his bill. Since the shrike's flight is not very swift, it was necessary for him to corner his victim or else so terrify it as to confuse it completely.

I recall an unhappy day when a cardinal, which is a rare bird in New York State, came flying through my garden toward the house, pursued at some distance by the shrike. The cardinal could easily have eluded the shrike, but apparently was so frightened that it dashed against a window and fell dead at my feet.

Usually, when the shrike appeared, the birds immediately "froze" and remained immovable until he either left or started in pursuit of some other bird. Once a bird had been caught, the shrike was unable to pluck it or tear it to pieces until he had impaled it on a thorn or wedged it in a narrow fork so that he could stand beside it.

During the winter the shrikes' migrations are erratic and dependent upon the abundance of food in the North. Some years they do not leave Canada and other years they reach Kentucky and Virginia.

The Loggerhead Shrike

(Lanius ludovicianus)

This familiar bird of the Atlantic and Gulf States is a smaller and bluer edition

of the Northern shrike, with the black lores connected by a black line above the bill (see Color Plate VII). It is represented in all parts of the United States by one variety or another, which vary but little from the parent stock here illustrated.

Being smaller, this bird feeds more upon insects than his Northern cousin, but he can be quite objectionable around feeding stations where small birds are numerous. He builds a bulky nest during April in a thick bush, leafy tree or vine and is quite a devoted parent.

Because of their predacious habits, they perch on exposed places where they can view the landscape and are familiar sights on the telegraph wires.

The Vireos

The vireos constitute another New World family of birds of which the majority of the 75 species are confined to tropical America, only twelve reaching the United States. Were it not for their songs they might easily be overlooked, for they have neither the active flitting habits nor the bright colors of the warblers and flycatchers (see Color Plate VIII).

These greenish little birds, which are smaller than sparrows, spend their lives gleaning among the leaves of forest and shade trees or in the undergrowth, where their coloration is very protective.

So loud and so oft-repeated are their songs, however, that anyone with an ear for bird music has no difficulty in finding them.

The nests of the vireos are pendent little baskets fastened at the rim in a small fork. The white-eyed and least vireos build in the undergrowth; the red-eyed and blue-headed in the lower branches of small trees; the yellow-throated in the center of a tree, on lateral shoots from the trunk; and the warbling vireo in the tree tops.

Most vireos are rather fearless of man, especially when nesting, and I have many times enjoyed the sensation of stroking a blue-headed or red-eyed vireo on its nest or of watching a yellow-throated vireo at arm's length.

The song of the warbling vireo is a continuous warble, like that of a purple finch, but with a rising inflection at the end fitting the words, "If I could see it, I would seize it, and would squeeze it till it squirts."

The red-eyed vireo seems to say, "Look up—way up—tree top—etc.," while the yellow-throated sings more slowly and huskily, "Cherries—sweet cherries—have some." Both species keep up their refrains during the nesting season from daylight until dark with scarcely a pause.

The red-eyed vireo *(Vireo olivaceus)* everyone hears but few recognize. Widespread in summer throughout North America wherever there are trees, from central Florida to central British Columbia, it sings continuously from the time it arrives, in April or May, until it leaves for South America, in September or October.

In spite of its wide range, the red-eyed vireo shows remarkably little variation and has not been divided into any subspecies as have so many of the other vireos.

The warbling vireo *(Vireo gilvus)* is found from the Atlantic to the Pacific north of North Carolina and south of central Ontario. Perhaps because of its inconspicuousness, it is one of the few North American birds whose winter home is not definitely known, though of course it is somewhere south of the United States. The red-eyed vireo winters from Colombia to Brazil, but the warbling probably does not go quite so far, for it arrives on its nesting grounds nearly a week earlier.

The least vireo *(Vireo belli)* lives in the thick brush of our arid Southwest and is more often heard than seen.

The blue-headed vireo *(Vireo solitarius)* is a striking bird, with its blue-gray head, pronounced white eye-ring, wing bars, and white throat. Its confiding ways and early migration northward before the leaves have unfurled make it better known, even though it is much less numerous than the red-eyed or warbling vireos. It ordinarily winters in the Gulf States and spends the summer in southern Canada.

The white-eyed vireo *(Vireo griseus griseus)*, because of its brushy haunts, is difficult to get acquainted with. In summer it is found throughout eastern United States as far north as southern New York and New England.

The yellow-throated vireo *(Vireo flavifrons)* nests from northern Florida to central Texas and northward to Maine and east central Saskatchewan. Its throaty song somewhat resembles that of the red-eyed vireo, but is louder, slower, and more buzzy.

The Hutton vireo *(Vireo huttoni huttoni)* can be found west of the Sierras from Vancouver Island to Lower California, in the belt of live oaks and firs.

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MANLESS ALPINE CLIMBING

The First Woman to Scale the Grépon, the Matterhorn, and Other Famous Peaks Without Masculine Support Relates Her Adventures

BY MIRIAM O'BRIEN UNDERHILL

ALTHOUGH climbing the big rock and ice peaks of the Alps is a sport that gains immeasurably in interest, fun, and excitement from "doing it on your own," only recently has this been considered at all proper, even for men. For women to climb not only without guides, but without men companions, is still unusual. With a few exceptions,* women have never climbed alone.

The essence of guideless climbing consists in taking, oneself, the entire responsibility for carrying the climb through to a successful finish. This is a lot of fun, and I saw no reason why this pleasure should be closed to women, although some of my friends among the French men mountaineers tried patiently to explain to me why it was theoretically impossible for a woman to lead a mountain climb, taking the entire responsibility herself without at least masculine "moral support."

THE GRÉPON THREATENS AND ALLURES

I was unconvinced, however, and I persisted, albeit very privately, in my determination to do a big climb *sans hommes*.

Furthermore, I vowed it should be the traverse of nothing less than the most famous of the Chamonix Aiguilles, the Grépon itself! We should see whether women could climb on their own!

Of course, the Grépon—I barely acknowledged this ambition even to myself—was not to be thought of as a first manless climb. Though I had led it the year before (to "lead" being to go up first on the rope), I had taken with me a professional porter, a man capable of assuming the entire responsibility and doubtless certain in his own mind that he had done so.

Far more difficult than anything attempted before by women alone, though not to be compared with some recent climbs, the Grépon had counted for years as one of the hardest rock climbs in the Alps—one that even some of the licensed Chamonix guides cannot lead. It needed working up to.

The Peigne (about 10,500 feet), another one of the Chamonix peaks, seemed suitable for a beginning, since, while lower and less difficult, it is in many ways like the Grépon, with bold, sweeping, vertical lines and sheer granite walls. Women had climbed it with men, but never alone.

Fortunately, I had right at hand a friend, Miss Winifred E. Marples, of London, who felt as I did about manless climbing, and with her I set out. In the evening of August 13, 1929, we arrived at the little chalet of Plan de l'Aiguille, some 4,000 feet above Chamonix and just under the Peigne.

* The baronesses Rolanda and Illona Eötvös, of Budapest, did several Dolomite climbs shortly before the war, and three English women, Miss Bray, Miss Dorothy Pilley (now Mrs. Armstrong Richards), and Miss Wells (now Mrs. Hurst), did some climbs in the Saas-Fee region in 1920.

Photograph by Miriam O'Brien Underhill

JUST LEAN BACK AND RUN DOWN

"Roping off" is a device for descending vertical pitches or others not easy to negotiate, but it cannot be recommended to the inexperienced or to those subject to dizziness.

We might have reached the same starting point by leaving Chamonix the next morning, in the first swinging basket on the Aiguille du Midi aërial railway, but we wished to get an earlier start, and thus avoid guided parties and escape the suspicion of benefiting by the experience of a good guide without paying for his services. Since this was our first manless climb, we purposed to do it absolutely unconducted.

ADVENTURE BEGINS WITH THE PEIGNE

Our landlord woke us for breakfast tea about 4 o'clock the morning of our climb, and we started off in high spirits, with our little candle lantern casting its beams feebly into the darkness. Having scouted a bit before going to bed, we knew the way over the grassy alplands to the rocky moraine along the right bank of the Glacier des Pèlerins. Our precaution insured us against the humiliation of getting lost in the pastures before daybreak and wasting valuable time.

It was not quite light when we reached the foot of the steep, snow-covered fan—the "cone of dejection" the French call it—to which the moraine leads; but on the snow we could see well enough to start up. The snow was frozen hard; our nails bit well; and, although the cone was steep, we could walk up it with just a nick from the ice ax now and then for a footstep.

We knew well enough that we ought to delay then and there to cut a good line of steps for use in descending that afternoon, when the snow would be softer and our nails would not hold. It is easier to cut steps going up, on the hard morning snow, than to lean far out from a precarious foothold on a steep slope and hack them going down, in the afternoon, while pieces of ice and rocks loosened by the sun come crashing down from the *couloirs*, or gullies, that drain the mountain walls.

Nevertheless, we neglected step-cutting and walked on up the fan toward the couloir that comes down from the Col du Peigne, thinking of the guided parties that would be right on our heels as soon as the first basket train came up from Chamonix. Let the guides cut their inevitable elephant-size steps to walk down in! We might as well keep our lead.

Crossing fairly easily the *bergschrund*, that large crevasse that almost always splits open where the lower-lying glacier separates from the main rock or snow mass

of the mountain, we reached the rocks at the side of the couloir. From there on it was just sheer fun, rock climbing on good firm Chamonix granite.

Finding the route was easy enough. We knew from the guidebook that it followed first the right and then the left bank* of the couloir from the Col du Peigne, a steep, narrow cleft rising nearly 1,400 feet above, between the walls of the Aiguille du Peigne and the Aiguille des Pèlerins. For the details of the course, we followed in general the most likely looking line over slabs and up little cracks and chimneys, and we were gratified to find that the nail scratches on the granite rocks usually went the same way.

THE LAST FEW FEET THE HARDEST

Soon we were at the level of the Col du Peigne and facing the final wall of our peak. Here came the most difficult rock climbing of the day—a long, steep chimney, with good but sometimes smallish holds.

The guidebook had made me a little wary of this chimney by warning that it increased in difficulty as one ascended, and that the last 30 feet became especially delicate because of the rarity of holds. I therefore brought up my "second man" at fairly short and frequent intervals, employing that favorite dodge of the leader who is not quite sure of what is coming next.

In rock climbing that is at all difficult, only one person moves at a time, the others being in secure positions and always ready, should anything happen, to hold the rope. If the second or third man should fall, those above could usually check him almost instantly. If, on the other hand, the leader should fall, he would probably have to drop twice the length of the rope before the second man, below, could hold him.

Nothing happened, however, and soon we were on the summit ridge, a narrow crest of huge, upstanding granite blocks. We scrambled joyfully along these and passed a pleasant half hour on the summit eating a mid-morning lunch and admiring the magnificent precipices of the aiguilles around us. Then we came down from the

* Right and left, as applied to couloirs—or glaciers, rivers, ice falls, etc.—are always taken from the point of view of the couloir. For instance, the right bank of a couloir running downhill toward the south would be on the west. As you go up the couloir, however, its right bank is to your left.

Photograph by Mrs. Dean Peabody

NO MORE HANDHOLDS!

To reach the top of this little spire in the Chamonix Aiguilles, the author climbed the ridge seen running up its center, clasping the camera in her teeth.

Photograph by Bradford Washburn

SOME FINESSE IS REQUIRED TO BACK OFF THIS BLOCK

Hanging the rope by its midpoint over the upper corner of the Grand Gendarme of the Grépon, the alpinist slides down astride the edge with one leg and arm on each side and holding one strand in each hand. If he falls to the left, he lands 3,000 feet below; if to the right, 5,000 feet. Good climbers are careful to hold on to both ends of the line!

farther end of the summit ridge, "roping off" a time or two (see illustration, page 132), and rejoined our route of ascent in the couloir.

When we reached the top of the snow fan, at the gully base, we suddenly realized that there had been no other people, guided or otherwise, on the mountain all day, and that we had no steps cut for the descent!

I was all in favor of taking the whole cone in a standing glissade, which is the same motion as skiing, only without skis. Miss Marples, however, objected on account of the piles of jagged rock at the bottom of the snow slope. She had slid into them once.

Retreating in the face of bad weather, on a previous attempt at the Peigne, she had been jerked out of balance on this snow slope by a gentleman, one who has since done, in the Himalayas, one of the biggest climbs that has ever been accomplished by man (even the gods slip up sometimes), and both of them had rolled into the rocks and got scratched up a bit.

We compromised, cutting down the upper half of the cone and glissading the lower.

"AN EASY DAY FOR A LADY"?

The Peigne having gone off well, in good time, and without any of the catastrophes that had been prophesied, I felt much reassured, even a little elated, and ready to take on the Grépon itself without further delay. Three days later, therefore, Madame Alice Damesme, of Fontainebleau, and I did the first manless traverse of the Grépon.

Mummery, the great English climber, who, in 1881, was the first to reach the summit of this peak, says: "It has frequently been noticed that all mountains appear doomed to pass through the three stages: an inaccessible peak, the most difficult ascent in the Alps, an easy day for a lady."

I must confess that the Grépon has not yet reached Mummery's final stage, and that the heading, "An Easy Day for a Lady," which the London *Times* put over the paragraph describing our climb of the peak, is not an altogether accurate description of the affair.

The summit ridge of the Grépon, approximately horizontal, resembles a crenelated wall with five or six spires or pinnacles. The sport consists in reaching this ridge at its north end and traversing over and around the pinnacles to the south, where one descends to the Col des Nantillons. On the west side the sheer granite wall drops in one sweep 3,000 feet to the Glacier des Nantillons, and on the east 5,000 feet to the Mer de Glace.

Mummery and his guides, Burgener and Venetz, had reached the summit of the Grépon from the north by essentially the same route as that used to-day. Four years later, in 1885, M. Dunod and his guides reached the summit of the Grépon by its southern ridge.

The first complete traverse of the peak (and the fourth ascent)—up the north side, over the summit ridge, and down the south—was accomplished in 1892 by Mummery himself with three friends, guideless, and in 1893 Mummery led a party over the Grépon that included the first lady, Miss Bristow, "who had ever stood on this grim tower."

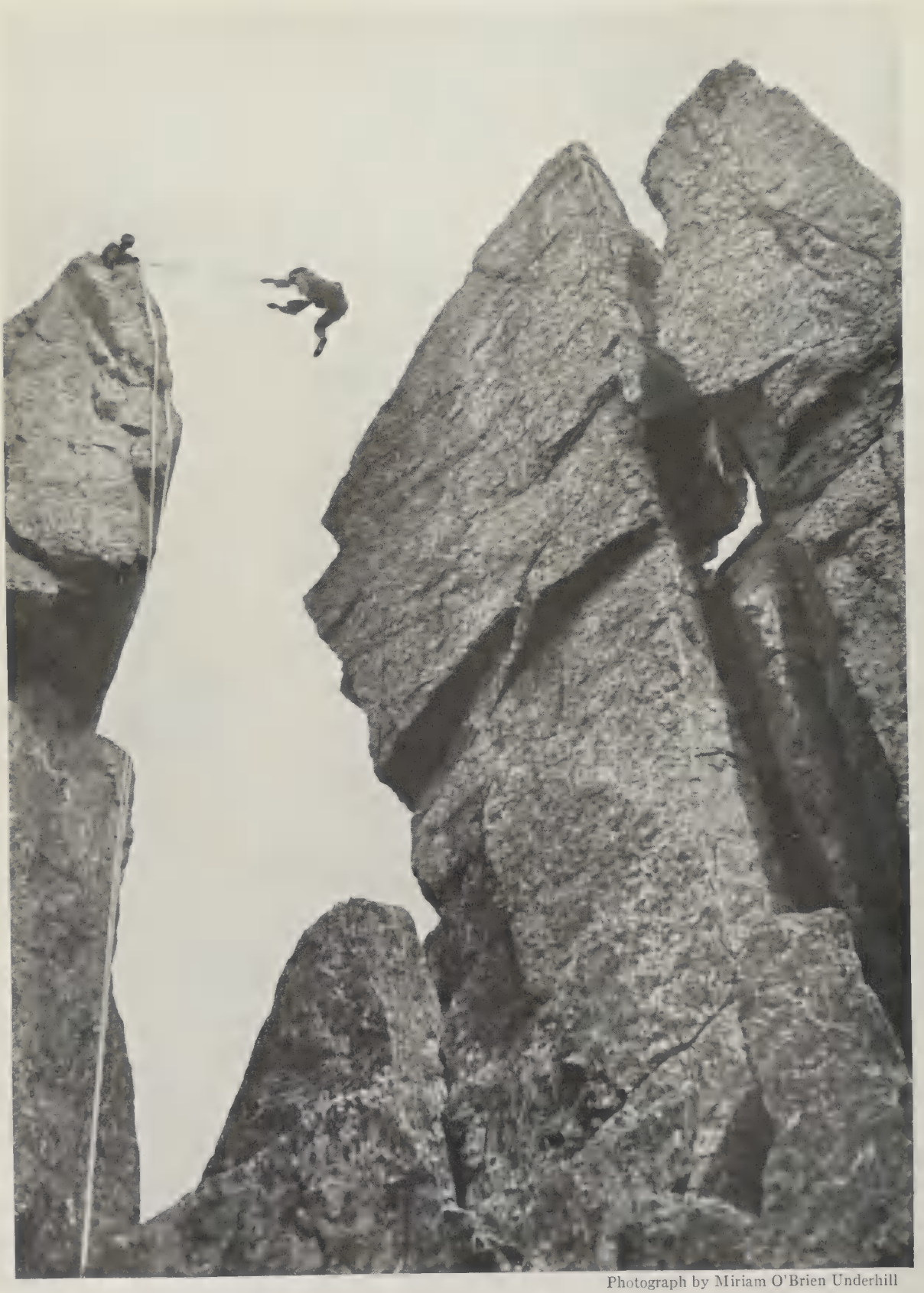
Alice and I left the Montenvers Hotel at 2:35 on the morning of August 17. At 5:40 we had reached the "breakfast place," the Rognon des Nantillons, a rocky promontory emerging from the lower end of the Glacier des Nantillons (see illustration, page 142). Several "caravans" were breakfasting together there; for as far as that point the routes to three aiguilles—the Charmoz, Grépon, and Blaitière—are the same.

Upon learning what Alice and I intended to do, all asked incredulously, *"Vous deux seules?"* and courteously attempted to conceal their smiles when we replied that indeed "we two alone" were essaying the Grépon.

They were good sports, however. As we left the Rognon they politely held back and allowed us to lead the way up the Glacier des Nantillons and on up the rocks—relatively easy except for one or two pitches—to the Charmoz-Grépon Col, the depression between the Charmoz and the Grépon where the serious climbing begins.

The wall of the Grépon rising above the Col looks unclimbable. It is unbroken except for a narrow crack between the main wall of granite and a half-detached slab that lies against it. This is the famous Mummery Crack, 60 feet high, and the only way from here up to the ridge (see illustrations, pages 156-7).

In 1892 Mummery, guideless, made his second ascent by this route, leading the crack himself. He wrote of it, "It is the



Photograph by Miriam O'Brien Underhill

IT WOULD BE "ONLY A COUPLE OF JUMPS," ANYWAY

The method demonstrated in this traverse between two of the Clochetons de Planpraz, above Chamonix, permits the conquest of an unclimbable tower. The alpinist lassoes the summit from an accessible eyrie and goes across on the rope. The start is the hardest, for he must force apart the two lines under his knees to keep from swinging around underneath. The improvised trolley sags when weight is put on it, making the take-off alarmingly downhill.

toughest bit of rock climbing I have ever attempted."

LADIES FIRST UP MUMMERY CRACK

At the Col we found two climbers who had come over the Aiguille des Charmoz—Armand Charlet, Chamonix's best guide, and Mr. Guido Alberto Rivetti, of Biella, Italy. This party should naturally have preceded us up the crack; but, knowing well that we would like to go ahead, Armand announced that they were stopping at the Col for a lunch.

A few of the younger and better guides take a most sportsmanlike attitude toward the "sans-guides." Keen climbers themselves, they appreciate the spirit that makes people wish to do climbs on their own. I do not believe they feel seriously worried that women, at any rate, will take many of their jobs away from them!

Since I had led the whole climb, with a porter behind me, the summer before and Alice had never led it, we readily agreed that she should have the privilege of going ahead. She (in 1929) and I (in 1928) are the only women who have led the Mummery Crack.

Photograph by Robert L. M. Underhill

NO TRUE MOUNTAINEER LEAVES THESE BEHIND

Modern ice axes are about the height of a comfortable cane, considerably shorter than those formerly used. A large rucksack, partly filled, "rides" better than a smaller one, stuffed. For coolness, the rope is often worn between the bag and the climber's back, or, as here, tied on the outside. There is never room for it inside.

The crack is climbed by jamming in the right hand and the right foot and alternately raising them, first supporting the weight on the foot and working the hand higher; then holding everything on the jammed fist and lifting and again wedging the foot. The left hand feels over the outside of the slab, clinging, as Mummery says of another of his climbs, to slight "discolorations in the rock." The left foot, useless, swings in the air.

It is hard, strenuous work, particularly at the bottom, where the crack overhangs slightly, so that the climber is leaning backward as he works his way painfully up. After about 30 feet, there is a platform, a small outward-sloping shelf, where he can rest. Above that the crack becomes wider and not quite so difficult, although still very fatiguing.

Non-climbers often ask me how a woman can be strong enough for exertion that would tax an "athletic young man." Strange as it may seem, physical strength is a relatively unimportant part of the equipment

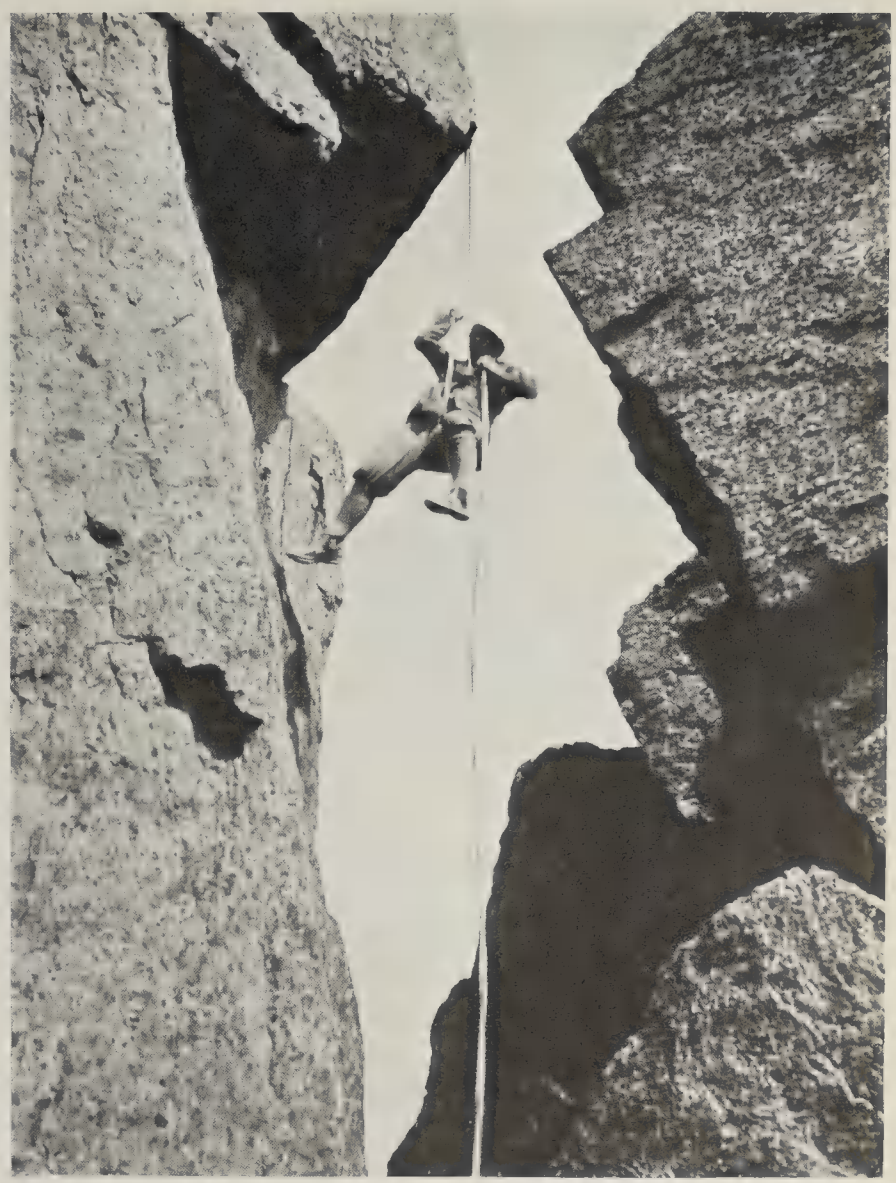
Photograph by Capt. Albert H. MacCarthy

THE GRÉPON THRUSTS UP LIKE A JAGGED SPEAR HURLED BY A TITAN

It defied all attempts to climb it until 1881, when it was finally conquered by the British mountaineer, A. F. Mummery. The author's party have been the only women thus far to make the ascent without masculine aid or accompaniment. On the left ridge is seen the "Cannon Hole," through which one passes shortly after negotiating the Mummery Crack (see pages 156, 157). On the right is the sheer west face that drops 3,000 feet to the Glacier des Nantillons.

THE NEXT FIVE FEET ARE THE MOST NERVE-RACKING

Roping down one of the Clochetons de Planpraz, above Chamonix, Florence Peabody is sliding with her feet against the rock, but after she passes the overhang there will be no wall within reach.



Photographs by Miriam O'Brien Underhill

WITH THE ROCK OUT OF REACH, ONE SHOULD GO DOWN FAST

The twist of the rope usually causes the climber to spin when roping down in the open. Therefore, after passing the overhang, she hurries to reach the bottom before becoming dizzy (see page 136).

Photograph by Bradford Washburn

THE GRÉPON PROVIDES A LUNCHEON TABLE FOR ITS CONQUERORS

The triumphant mountaineer is standing on the summit, a large flat rock, which he has reached by climbing up a crack. Five thousand feet below, to the left, is the crevassed Glacier du Géant, and in the background the Col du Géant, on the Italian frontier. After the author and companion had accomplished the ascent of this needle, a famous man mountaineer announced sadly that the Grépon had "disappeared" (see text, page 146).

necessary to lead the Mummery Crack or most other Alpine climbs, for that matter. A certain muscular vigor is indispensable, of course, as indispensable as having a right arm and a right leg and just as elementary; but technique, knowing how to use strength to the best advantage, is more important. The greater the technique, the less the power required. Of the many "athletic young men" in the valley of Chamonix, few lead the Mummery Crack.

No one who goes up first without the security of a rope from above can make the slightest slip, the slightest miscalculation, in climbing at least the upper part of the Mummery Crack, and live through it. The climber knows this well, as he clings there, looking down at his friends 60 feet below and then at the jagged precipices hundreds of feet beneath them.

NERVE CONTROL INDISPENSABLE

He cannot get panicky. He cannot allow his muscles to become tense and thus needlessly use up energy. Because there is real danger of becoming stuck, he cannot jam himself too far inside the crack in the almost instinctive effort to "get in out of the view," but must keep well outside, where progress is easier. He cannot hurry; he must be just as calm and cool and unflustered as if nothing whatever depended on his getting up.

Alice was perfect. She climbed that crack with the poise and assurance of a lady crossing her drawing-room floor, and we all cheered when she reached the top!

The person who climbs the Mummery Crack with a guide, professional or amateur, knows nothing of all this. Held by a reliable rope from above so that the penalty for failure is reduced from everything to nothing, he struggles merely with the physical difficulties—and loses, in my opinion, a major part of the fun of the climb.

After the Mummery Crack we had a delightful series of rock problems, as we climbed up and down over the different towers—overhangs, narrow tunnels, small ledges, smooth blocks, and all the rest. Each problem called for its own technique and all of them used many muscles.

One of the towers, the Grand Gendarme, is a huge squarish block resting on another smaller block, and the distance down to the gap on the farther side is some 50 feet. The descent is made by "roping down"—that is, by hanging the rope by its midpoint over the top of one of the vertical edges of the upper block and sliding down this edge with one leg on each side, holding one strand of the rope on the left wall and one on the right (see illustration, page 134).

The start is sensational, a backing off into space with a drop below of half a mile! I have seen climbers hesitate for a long time before managing to do this, even when they were held firmly on a second rope by a guide above.

Neither Alice nor I had any anchoring rope when we backed off here. We had not wished to carry two ropes, and our climbing rope of 150 feet was needed for the rope-off.

The actual summit of the Grépon is a large flat rock (see illustration, opposite page). Here we all had lunch together—Mr. Rivetti, Armand, Alice, and I—while my mother and Alice's small daughter watched us through telescopes from Chamonix (see illustration, page 170). Lunch was made entertaining by the facetious Mr. Rivetti, who delivered an impassioned oration on the humiliation suffered by a man, and a man who had always considered himself a good climber, at being escorted over the Grépon by a guide on such a day as this.

Leaving the summit at half past 10, we roped off again, on the Mer de Glace side, where the drop to the glacier is a vertical mile. For roping off there are different methods of arranging the rope around the body to give varying degrees of friction, but in any case one should lean well back, keep the hands up and the feet slightly apart for better balance, and then run lightly down (see pages 132 and 144).

LETTING GO OVER A MILE DROP

At this particular place it is necessary to go down over rather a large overhang, and as the feet step over the overhang, and the body naturally swings in toward the rock, there is danger of scratching the hands against the edge of the rock (see illustration, page 165). The way to avoid this is to let go of the rope just above the edge of rock and quickly grab it again underneath.

Once at the Col des Nantillons, the rock climbing is over, and from there down to the Rognon one follows the rather steep Glacier des Nantillons, crossing a few crevasses on the way (see illustration, page 145). At one point it is necessary to pass

Photograph by Miriam O'Brien Underhill

CLIMBERS HURRY A LITTLE BENEATH A HANGING GLACIER

Before the ascent of the Grépon (partly hidden by clouds in the left background) begins, there are several hours of laborious walking up the Glacier des Nantillons, the stream of ice and rock flowing down this valley. Parties usually pause for breakfast on top of the rocky promontory in the center. From here they pass the base of dark cliffs, over which hangs a jagged glacier (upper center). Masses of ice break off from time to time and are considered dangerous to climbers (see pages 141 and 145).

Photograph by Miriam O'Brien Underhill

LADY CLIMBERS HAIL THIS AS FASHIONABLE WEAR

The heavy 12-point crampon designed by Grivel, of Courmayeur, Italy, lessens slipping on steep ice climbs. Iron spikes on a steel framework are hand-forged to fit the boot, and the device is fastened on by webbing or leather straps. Because her companion forgot her crampons, the author's climb on the Mönch was difficult (see page 155). On ascents over mixed ice and rock, a model without the two front prongs must be used.

© Donald McLeish

SWISS ALPINE CLUB HUTS ARE CLEAN AND COMFORTABLE

Built high on the mountain sides, they enable climbers to make ascents and get back without sleeping in the open; but quarters may be crowded. Jessie Whitehead loved to shock her friends by telling them she slept in a tiny Alpine hut next to a young man who kicked her all night. The braided rope hanging from the rafters is not considered good equipment nowadays and the ice ax is too long.

Photograph by Robert L. M. Underhill

"ROPING OFF" THUS, ONE MAY GET HOT UNDER THE COLLAR

As the man runs down, the rope sliding around his body affords so much friction that little weight is carried on the hands, but the neck must be kept covered. To go faster, he pulls up the free lower end.

Photograph by Micheline Morin

A LADDER MADE EASY THE WORST JUNGFRAU CREVASSE

Though the guides had removed most of the hazard, there was still a bulge of ice on the upper lip. The author had to cut a few holds to climb out over this.

Photograph by Miriam O'Brien Underhill

CLIMBERS MUST TEST EACH FOOTSTEP AMONG THE CREVASSES

When crossing a crack by a bridge of snow, they constantly feel out the firmness of the footing by thrusting ahead with the ice ax (see text, pages 141 and 160). Two persons are seen here crossing such a precarious span on the Glacier des Nantillons, approximately in the middle of the picture.

along the base of some cliffs with a hanging glacier projecting over them, from which huge blocks of ice break off from time to time (see illustration, page 142). One's pace usually quickens a bit here.

We reached the Rognon again at five minutes after 1, and there waited for Maurice Damesme (Alice's husband), Winifred Marples, and René Picard, who had done the traverse of the Grands Charmoz that day. That morning Alice and I had left our crampons rather too high up on the glacier, at the foot of the rocks below the Charmoz-Grépon Col, and we should have been obliged to climb up again a considerable distance to fetch them, had these others not brought them down to us. It is rather convenient, I have noticed, when doing this manless climbing, to have a husband or two around to gather up the loose ends!

That evening some friends arrived in Chamonix and asked for the latest news. "The Grépon," replied Etienne Bruhl, "has disappeared." To their astonished protests he explained that, while there might still be some rocks standing where the Grépon used to be, the climb no longer existed; for no self-respecting man could undertake it, now that it had been done by women alone.

The next season I was able to do only one manless climb, the Torre Grande, in the Dolomites, one of the towers of the Cinque Torri group near Cortina d'Ampezzo. Miss Marjorie Hurd, of Cambridge, Massachusetts, was my companion on this adventure.

I should like to do more manless climbing in the Dolomites, since it has long been one of my favorite regions in the Alps. Dolomite climbing is rock climbing *par excellence*. The rock is a magnesian limestone, very firm and solid, often almost vertical in its forms, but so broken up into little projections and hollows, resembling in texture a solidified sponge, that steeper and more startling routes are possible on it than in most mountain regions.

KING ALBERT'S FAVORITE CLIMBS

For these reasons, no doubt, the Dolomites were long a favorite climbing ground of the late King Albert of the Belgians, an excellent mountaineer and a particularly brilliant rock climber. Of course, he visited other climbing regions as well—Courmayeur, Chamonix, the Engelhörner—but almost every September he was back at Tre Croci, just above Cortina, for a round of his favorite sport. Queen Elizabeth occasionally did some of the easier climbs, but not in the last year or two.

The King was once climbing in the French Alps when I was there with French friends, and extended an invitation to some of the best climbers among the Frenchmen to get up a guideless expedition. The climb did not come off because of unfavorable weather, but the chosen ones were primed as to the proper etiquette. Formality, it seemed, diminished with altitude; so that when one got to a mountain hut it was necessary to use only ordinary courtesy in passing His Majesty the omelet, while out on the climb itself all restrictions were thrown aside and one could "swear at him as if he were one's most intimate friend." The true sporting attitude!

I never saw King Albert in the Dolomites, partly because he went there in September and I preferred my Dolomites in the spring. It is just as well, perhaps, that we were not there at the same time, because we should both have wanted the same guide, Angelo Dimai, the best rock climber I have ever seen. I did a great many of the climbs enjoyed by the King.

Once when Angelo and I were making the first descent of the Spigolo (ridge) of Punta di Fiammes, a route which we had already ascended some years previously, I saw a *piton** firmly driven into the rock at a traverse where a slip would have entailed an awkward pendulum. I remarked that this safety device had not been there when I had last seen the place.

Angelo replied that he had put the piton in when he had taken the King of the Belgians up this route, because—very gravely and seriously—"when I am climbing with the King of the Belgians I don't want to have any accident. Of course," he added quickly, with a twinkle, "when it's only you, I don't care."

The closest I ever came to the King of the Belgians was in Angelo's guide's book, where for several years our signatures followed each other on alternate pages: "Albert, roi des Belges . . . Miriam E. O'Brien . . . Albert, roi des Belges . . . Miriam E. O'Brien."

Every Dolomite guide, like those in many other Alpine regions, has an official notebook containing his guide's license, printed

* A piton is an iron spike with an eye through which the rope can be assured by means of a snap-ring.

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OLD FRIBOURG, LOOPED BY THE SARINE RIVER, SEEMS A MOATED CASTLE

The weathered buildings of this stream-guarded city cling to steep hillsides, many of the lower windows overlooking the valley, being below the level of the narrow, crooked streets. Dominating the scene rises the 13th-century Gothic cathedral, St. Nicholas, which houses a remarkably pure-toned organ of 7,800 pipes.

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Natural Color Photograph by Hans Hildenbrand

FIVE CENTURIES AGO A HEROIC LITTLE BAND SAVED WERDENBERG CASTLE FROM AN INVADING HOST

To-day, descendants of the warriors live in the old gabled houses of the village, cultivate their vineyards and orchards, and make the fine lace and embroidery for which Switzerland is famous.

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Natural Color Photographs by Hans Hildenbrand

IN SWITZERLAND 24 DISTINCT TYPES OF COSTUMES ARE PRESERVED FOR FETE DAYS

Each of the 22 cantons, of which two are partitioned into independent halves, has its peculiar style of dress for both sexes, as well as separate parliament, local government, and officials. The girls on the left smilingly present the garb of the Inner-Rhoden division of Appenzell. Costly chains of chased silver or gold, attached to the guimpe, flash against tight velvet bodices. On the right, a daughter of Samaden in Upper Engadine displays her frock of

THE NEW BOVAL HUT STANDS ON AN ISLAND IN A RIVER OF ICE

Climbing enthusiasts who prefer exploits not too dangerous find delight in the trip up the crevassed Pers Glacier in Upper Engadine. They can rest in comfortable quarters of the shelter before essaying the final drive to the summit.

© National Geographic Society Natural Color Photographs by Hans Hildenbrand

GIRLS DRESSED LIKE THESE SAT ON THE SAME BALCONY CENTURIES AGO

Exquisite wood carving, such as that on the arches supporting this roof, distinguishes many ancient homes in Schuls, Lower Engadine. The young ladies' costumes probably are new, but they follow faithfully the old style peculiar to inhabitants of the half-canton (see Color Plate III).

SUNSET ON LAKE GENEVA MAKES ÎLE DE SALAGNON A FAIRY PALACE

For years the French artist Chartran lived in the chalet on this islet. Rousseau also contributed to the fame of the neighborhood, and Byron immortalized the Castle of Chillon not far away with his poem about Bonivard, who for six years was imprisoned in the dungeon there.

© National Geographic Society Natural Color Photographs by Hans Hildenbrand

ONCE A MONTH DÜDINGEN GIRLS PUT ON THE OLD COSTUMES

The crowns, decorations for bridal and christening ceremonies, and the "millstone" collars are features of the attire which the village church preserves for processions in the Canton of Fribourg, one of the earliest to be organized in Switzerland.

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Natural Color Photograph by Hans Hildenbrand

PEAKS CHALLENGING CLIMBERS TOWER ABOUT "THE NEATEST VILLAGE IN THE LOWER ENGADINE"

Destroyed by fire in 1921, Sent was rebuilt in the traditional manner, with frescoed houses. Costumes worn by the girls of the town differ from those of Upper Engadine (compare Plate III, right), where a more rigorous climate requires warmer clothing. A Swiss society for the preservation of the disappearing folk garb was organized a few years ago, and to-day needles fly, making new dresses in the old-fashioned styles for holiday use.

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THE ALPHORN CAN SET WILD ECHOES FLYING

Formerly these mighty trumpets, usually fashioned from the curved root of the forest pine or Alpine fir tree, were blown on the heights to warn distant friends of the approach of foes. Later they became musical instruments

Natural Color Photographs by Hans Hildenbrand

A THOUSAND YEARS HAVE LEFT STEIN AM RHEIN UNCHANGED

Conscious of the charm of antiquity, the inhabitants of this village have preserved its quaint dwellings, keeping fresh the rich paintings that adorn the fronts of the oldest houses, and treasuring the fountains and the ruins of a

© National Geographic Society Natural Color Photograph by Hans Hildenbrand

GRIM GUARDIAN OF THREE FAMOUS PASSES

Built by the Duke of Milan in 1445, Castello di Montebello with its two sister strongholds at Bellinzona, Ticino, defied assault for more than half a century. The Swiss broke Italian shackles when they stormed it. The castle blocked the way between Italy and Germany, being the key to the St. Gotthard, Lukmanier, and San Bernardino Passes. To-day it is used as a museum, and a railway tunnel passes under it. Fine fruit is grown by the peasants of the town.

regulations for the control of the guiding profession, and numbered blank pages for his clients to record the climbs done with him, and a few words of appreciation of him as a guide. The aim of some guides is to have as many entries as possible, to show what fine fellows and popular guides they are. Others consider that it lends more "tone" to this volume to omit the more banal climbs.

I have never known one who pared his list so closely as Angelo. Personally I have always suspected that this may well have been a device on his part to fool the tax collector, since a guide's income taxes are based on the number of entries in his book.

PREPARING FOR THE MATTERHORN

In the season of 1931 my heart was set on climbing the Matterhorn manless. Though far less difficult technically than the Grépon, this famous peak is big and striking, with a formidable history and reputation. The climb presents no individual pitches of great difficulty, but it is tiringly long and higher than the Grépon by 3,000 feet.

To climb the Matterhorn, Miss Jessie Whitehead, of Cambridge (it may be either England or Massachusetts), Alice Damesme, and I were to meet in Zermatt on August 2. I hoped to get in training early in July by doing a few manless climbs in the Oberland with Mademoiselle Micheline Morin, of Paris. Up to date all our manless climbs had been primarily rock climbs, and we chose the Oberland region this year because there the climbs are mostly snow and ice.

The Jungfrau itself, most beautiful of the Oberland peaks, seemed a bit too easy by its regular route. We thought that its neighbor, the Mönch, separated from it by the Jungfraujoch, might be more interesting and still not too ambitious for a manless caravan on their first climb of the season.

Micheline and I arrived at the Jungfraujoch about 8:30 a. m., July 11, engaged our room at the excellent hotel which has been carved out of the rock and ice, left our toothbrushes, and started at once for the Mönch. In doing climbs from the Jungfraujoch, one has the advantage of being 11,400 feet up at the beginning and thus saving much exertion.

The ordinary route up the Mönch crosses the upper snowfield of the Jungfraufirn to the Obermönchjoch and then ascends the southeast ridge. It is throughout a snow-and-ice climb, and while the ridge is fairly steep in places, there is no great difficulty. We planned to use this route for the descent, and to go up by the southwest ridge, a more interesting climb, with some easy rock work as well as snow and ice.

Since the latter ridge runs directly up from the Jungfraujoch, we had only to walk around the little Sphinx and go up a steep but short slope of hard snow, crossing a small *bergschrund* on the way, to get upon the ridge itself. For most of the time we stayed on the crest of the ridge, finding it more amusing to climb over the gendarmes, or rock towers, than to go round them (see illustration, page 159).

There is only one little rock pitch of any difficulty, a slab where the holds, although good, are somewhat small for the big, heavily nailed boots that even a lady wears on the peaks of the Oberland. About halfway up, the rock climbing came to an end and the rest of the ridge was snow. Here we stopped for a little lunch and decided to put on our crampons (see illustration, page 143), for on the ridge ahead the snow was very hard and icy.

FORGOTTEN CRAMPONS MEAN TROUBLE

It then developed that Micheline's crampons were not in her rucksack; they subsequently turned up on the floor of our bedroom at the Jungfraujoch. This was something of a catastrophe, since there were no tracks of any previous party, and without crampons we should have to cut steps. Worse still, I should have to cut them all; the person who has crampons is the one to go ahead.

For my own well-shod feet I did not need steps and I did not purpose to waste any effort unnecessarily. I regulated the size of my steps, therefore, according to Micheline's protests. If she insisted that she absolutely could not advance in such small, sketchy steps, I would reluctantly cut them a little bigger; but if, on the other hand, she came along relatively easily, I knew that the steps were larger than necessary and accordingly reduced their size.

It took us a long time to reach the summit. All the way, there was very hard snow, almost ice—an unusual condition on this ridge. It was the first big climb of the year for both of us; we were not yet accustomed to the altitude; and steady step cutting at 13,000 feet takes one's breath. In

Photograph by John Holden

OH, TO BE ON THE SHELF!

Halfway up the Mummery Crack, the most laborious bit of rock climbing on the Grépon (see text, pages 135, 137), there is a small outward-sloping platform where one can take a breath before continuing the struggle.

the early afternoon we ate a second lunch on the top, in the midst of gorgeous Oberland views.

On our descent over the ordinary route we suffered another mishap. I heard a tinkling noise, and there was Micheline's ice ax sliding down into the bottom of some crevasse below!

It is not easy to walk down a narrow and steep snow ridge without either crampons or an ice ax, even when a big line of steps has been cut by other parties (see page 158). We adopted, therefore, the most elaborate system of precautions: Micheline would go down first the full length of the rope, while I, having a good stance because of my iron spikes, would drive my ice ax in up to the hilt, belay her rope around it, and let the line out as she advanced.

She was thus perfectly assured. When she reached the end of the rope, she would stand still while I came down. She, of course, could do nothing to assure me; but it was not necessary, with my crampons and ice ax, as long as I was not pulled off by some one else. I doubt that any party ever before came down the Mönch so carefully. The method was desperately slow, but safe. It was nearly 5 o'clock before we got down off the ridge onto the glacier, a half hour's walk from the Jungfraujoch.

THE ALPHUBEL—LURE OF THE UNKNOWN

On August 2, Jessie, Alice, and I met in Zermatt, as by our agreement of several months' standing; but the weather was in no way suitable for climbing the Matterhorn, and Alice, with an injured knee, did not feel that she was yet up to it. Jessie and I, therefore, did the Alphubel by the Rotengrat.

The Alphubel, 13,803 feet, is one of the summits in the Mischabel group that lies along the east side of the Zermatt Valley. Its ordinary route is entirely a snow or ice climb, but its west ridge, or Rotengrat, affords a more interesting climb of mixed snow and rock work.

This climb appealed to us particularly because neither of us had ever been on the Alphubel. To take a route up an unfamiliar peak with no tracks to follow or traces of other parties is thrilling adventure.

We started early, at 3:10, from the little chalet of Täschalp, where one spends the night, because from there to the summit of the Alphubel is a rise of 6,536 feet. After

hours of stumbling in the dark among loose rocks, a stretch of easy rock climbing, and a final thousand feet of ice-covered rocks, we reached the summit in good order. It was the descent, the ordinary route down the southeast ridge to the Alphubeljoch and down the Wandgletscher, that gave us trouble.

The snow was not in good condition and on the steeper parts we moved one at a time. Jessie would go down first, drive in her ax, and belay my rope around it, taking the rope in while I came to her, and then letting it out again as I went below. Then I would do the same for her. Each one of us moved two rope's-lengths at a time.

We had not carried crampons because they are heavy and it did not seem worth while, considering that the climb as a whole was so long and the part of it where we would have needed the crampons was relatively so short. They would, however, have saved us many minutes coming down this ridge.

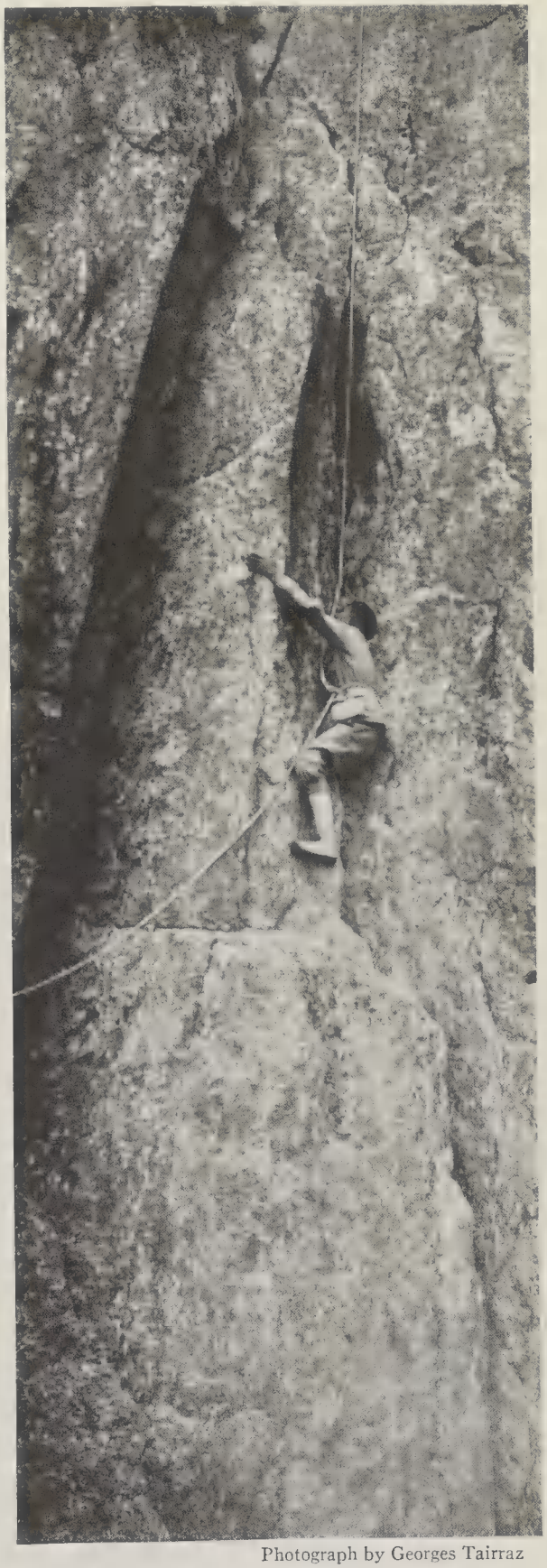
When we got to the worst part of all, a large ice bulge that must be descended, I fortunately happened to be ahead. The footing underneath was rotten. I could chop away as much ice slush on the almost vertical wall as I liked and I never got to anything solid underneath. Finally, with Jessie holding me firmly, I managed to get down.

It was not so simple for her, however, with no rope from above. Far below, I buried myself firmly to the waist in a small crevasse and invited Jessie to come along—to slide, if necessary, and I would field her in.

The only drawback to this plan was the presence of some sharp and hard-looking rocks not very far below me, much nearer me than the length of the rope between Jessie and me. Unfortunately, Jessie noticed these rocks, too, and she was, therefore, not any too keen on the sliding idea. She finally got down, however, quite properly, with not a slip.

REAL PERIL IN THICK MIST

When we reached the Alphubeljoch our troubles began in earnest. The clouds had been low all day and we were now surrounded by thick mist, with not a track or a trace to be seen anywhere, nothing but just whiteness.



Photograph by Georges Tairraz

ONE APES THE CATERPILLAR ON THE MUMMERY CRACK

The right hand and foot, jammed into the crevice, are raised alternately, while the left hand "clings to slight discolorations in the rock" and the left foot dangles uselessly in space.

Photograph by Micheline Morin

BLEST BE THE GUIDES THAT CUT SUCH BUCKETLIKE STEPS!

As the author comes down the steep southeast ridge of the Mönch, she is spared the labor of cutting her own path, a difficult and tiring task if one has to lean over from above to chop the snow (see text, pages 155-6). Magnificent views of the snowy peaks, green hills, and silvery lakes of the Oberland nestling far below reward the climber who masters this glistening monster.

Photograph by Miriam O'Brien Underhill

A STRONG WIND BOTHERS A LADY, THOUGH SHE HAS NO SKIRT TO WORRY ABOUT

Micheline Morin had trouble keeping her balance, as a near gale blew out her rope in a wide arc on the narrow southwest ridge of the Mönch. For convenience in roping down, a band marks the midpoint of the rope, 50 feet from the climber. The Jungfrau thrusts a massive head among its fellow giants in the background.

Photograph by Miriam O'Brien Underhill

FRESH SNOW AND ICE MADE THE MATTERHORN TREACHEROUS

Where the rocks are usually bare and dry, they were drift-covered and slippery, as Jessie Whitehead and Alice Damesme made their precarious way up the ridge.

We knew that some boys had come up to the Alphubeljoch that morning, but the snow had been hard then and the faint boot scratches, all the tracks they left, had long since been obliterated by the noonday melting.

Occasionally, on the way down, I thought I could distinguish a line of tiny holes, where the point of somebody's ice ax had been stuck into the snow at regular intervals. But that was all, and very vague it was at best.

Of course, we had a map and a guidebook and a couple of compasses; and we laid out our course by them, the second person holding the compass and seeing that the direction of the rope was kept approximately correct. We walked with almost the full length of the rope between us, theoretically the proper thing to do to prevent both climbers going into the same crevasse at once.

Jessie, behind, held a very taut rope on me every minute, while I, faced by a blank wall of white, tried to find the way down; but the Wandgletscher is a large glacier in a fog, with a lot of crevasses, and the diffused lighting of the mist made snow and sky, level and up and down, all look exactly alike. Not a step did I take without testing the snow in front of me before putting my foot on it.

"I'm trying to figure out the basis of your decisions," remarked Jessie, who was naturally watching with interest. "You plunge your ax into the snow; it goes in all the way easily, and you step forward with confidence. You plunge it in again; it goes in all the way easily, and you draw back in alarm."

The two situations did seem much alike, even to me. All the snow was suffused with water, soft and yielding; but if the texture of the snow seemed to become slightly firmer as the ax went down, I assumed solid glacier; and if the texture was less firm, or seemed like just air, I assumed a crevasse and tried somewhere else.

How tired I got of reaching forward and poking that ax into the snow! But it was not safe to take a single step without doing so. We found a lot of crevasses in our way, both open and snow-covered, some of which we could cross, while others we had to walk around.

Although the time and the distance seemed interminable, it was actually only an hour and twenty-five minutes until, trying to follow the ice-ax holes through a maze of crevasses where all the snow bridges were disintegrating, we made out a faint line of rocks on the right. An alternate route, I knew, ran down a rock rib in the middle of the glacier. Were these the right rocks?

They were, and we knew it when, on reaching them, we found a small pile of broken glass — the breakfast place. Never before has the sight of broken bottles given me such keen pleasure.

It was 8 o'clock before we were back at the Täschalp, where we ordered and consumed a Gargantuan dinner. We could, of course, have spent the night there, but we did not think our climb justified two nights out. After dinner we lighted our little candle lantern for the second time that day and started down to Zermatt. When we reached the main Täsch-Zermatt road the candle gave out—it is asking a good deal to expect a candle to work both ends of the day—and we finished our trip in complete darkness.

We walked into Zermatt at 11 o'clock, rounding out a good twenty hours of hard work. Of course, if one *had* to work as hard as that for twenty hours . . .!

Photograph by Miriam O'Brien Underhill

ONE MUST NEEDS APPROACH THIS CROSS HUMBLY

It stands on the Italian summit of the Matterhorn. As the two French climbers toil up the final slope, the effort demands a prayerful attitude.

THE MATTERHORN COYLY ELUSIVE

We passed the rest of the summer trying to get up the Matterhorn. All through August the weather was bad, and we never succeeded. Jessie feels that our attempts provided the comic relief in an otherwise deplorable season at Zermatt, and that the guides, in the long winter evenings ahead, could amuse themselves by thinking of those girls who tried so hard to get up the Matterhorn.

On August 6, Jessie, Alice, and I rode mules up to the Matterhorn Hut of the Swiss Alpine Club, at 10,000 feet, where one may spend the night before climbing the mountain. When we arrived we discussed sleeping places and other arrangements with the hutkeeper in German, with three nice Italian boys in Italian, with Alice in French, and with a stray American in English.

Jessie, feeling that there was not sufficient linguistic confusion, ventured a few

Photograph by Miriam O'Brien Underhill

TRIUMPH! ALICE DAMESME STROLLS ALONG THE CREST OF THE MATTERHORN

Her lofty promenade is on a narrow ridge, approximately 260 feet long. The Swiss summit, at the east, is—as determined by Swiss engineers—43 inches higher than the Italian summit, at the west (see text, page 170), but the spectacular view from either offers rich reward to the victor. On all sides lie magnificent mountain ranges—the snow-crowned giants of the Oberland to the north; the lofty snow dome of Mont Blanc to the west; and the Italian Alps and the rolling plains of Lombardy to the south.

Photograph by Mrs. Robert Lincoln O'Brien

MULES CARRY THE CLIMBERS TO THE MATTERHORN HUT

So frequently did the author and her companions make this trip over the dusty path from Zermatt that they felt personally acquainted with every saddle animal in service (see text, page 169). The riders, left to right, are Alice Damesme, Jessie Whitehead, and the author.

remarks in Latin. Sure enough, two of the Italian boys responded at once, and Jessie and they carried on a conversation that impressed us as having every appearance of a fluent discussion of the day's events, until we listened carefully and discovered that they were considering such burning questions as the division into three parts of all Gaul!

The Italian boys soon noticed that my Italian Alpine Club badge was not of the most recent model, with the Fascist symbol on it, and one of them insisted on exchanging it for his own. Then, on learning that Alice and I were indeed the girls who had done the Grépon manless, a second boy presented her with his badge.

Alice demurred a bit, pointing out that she had no "right" to wear it. They insisted vehemently that it was no question of right, that it was an honor to the Italian Alpine Club.

Poor Jessie was left out, with a courteous, but very brief, "We regret, Mademoiselle, that we haven't another one for you," a remark that was not strictly true, since they obviously still had the one that had originally been mine.

Jessie was furious, and rightly so, and insisted that Alice's flashing black eyes had a lot more to do with the question than climbing the Grépon. From then on her main purpose in life was to acquire an Italian Alpine Club badge. But the weather was so bad that no more Italians crossed the Matterhorn into Zermatt, and she was finally compelled to take extreme measures and join the club.

CLIMBERS SLEEP EN MASSE

In these little Alpine Club huts the climbers sleep in low-walled box stalls for six to ten people, with straw mattresses underneath, and usually in the Swiss huts there is at least one blanket apiece. (I'll never forget my first night in a French hut some years ago. "Here is a blanket, Mademoiselle," said the hutkeeper, doling them out. "Share it with the gentleman next to you.") The hut, as is usual for the Matterhorn Hut, was crowded, and Jessie later took great pleasure in telling some of her more conventional friends in the valley that she slept next to a young man who kicked her all night long.

Photograph by Miriam O'Brien Underhill

SLIDING SAVES TIME

To hang the rope around a projection and rope down is quicker and often safer than making the descent by foot and hand. Then the rope is brought down by pulling one end.

Before going to bed we scouted out the route for the next morning; but we were not called at half past 2, or at any of the other hoped-for hours. Jessie was disturbed enough to crawl out of her blanket and walk over all her sleeping companions to look out the window and find out why.

"It's snowing," she reported.

The next thing I knew she was shaking me and telling me the weather was fine. "It's 7 o'clock," she said, "but Bernhard Biner is starting up now and why can't we?"

We could. I sat up at once and dressed; dressing in a hut means pulling on your boots and lacing them up. At 7:25 we started. At 9:15 we caught up to Biner. At 10 we reached the Solvay Hut, a small refuge shelter slightly more than halfway up the Matterhorn ridge.

The weather meantime had been getting progressively worse. Jessie's clearing at 7 was just temporary. We stayed in the Solvay Hut for nearly an hour and a half, chatting with Bernhard Biner, one of the Zermatt guides, and his tourist, Yvonne Jérôme-Lévy, a friend of ours. Finally, in fine snow, we climbed down again and walked back to Zermatt.

The next day it cleared a little, and in the afternoon we again rode mules up to the Matterhorn Hut. The following morning, again, we were not called. At daylight we opened our eyes to a Christmas morning scene.

To wake on Christmas morning and see the window panes half covered with little drifts of fine, dry snow seems pleasant and suitable, but to open eyes to a similar sight on August 9, with the Matterhorn climb anticipated, brings no cheer to the heart. A real snowstorm not only interferes with climbing for the duration of the storm, but it plasters the mountains white with treacherous sheets of snow and ice that effectively prevent climbing for many days afterward.

Glissading the scree slopes above Staffel Alp on our way down to Zermatt in this pretty snowstorm, Alice hurt her knee again and was not able to do any further climbing that year. Jessie and I left that afternoon for the Oberland and, for a change of scene, passed the next few days watching the Oberland snowflakes fall.

On the evening of August 12 we received from my brother, who had remained in Zer-

matt, a telegram that the barometer was going slowly up and a clearing north wind was blowing. We rushed back to Zermatt and the next night slept again at the Matterhorn Hut.

HOPE SPRINGS ETERNAL

The hutkeeper, Kronig, was by this time a great friend of ours and sincerely in sympathy with our aspirations. He knew that we desired, as usual, to start ahead of the guided parties, and his method of arranging this for us, though indirect, lacked nothing in effectiveness.

The duties of the hutkeeper include serving tea in the morning, or at least being in charge of the stove and providing the climbers with hot water. He first served a pot of tea to Jessie and me, just enough for the two of us. No one, of course, took exception to this priority, since we were the only party of ladies.

Then it developed that there was no more hot water! The other parties had to wait, fuming with impatience, while the hutkeeper cut a little wood, stirred up the stove, and heated water for the rest of them.

Jessie and I got away at 3:10, with a good fifteen minutes' start. We put our rope on in the hut, for in five minutes we should be at the beginning of the rock climbing. The first pitch, since it is usually done in darkness, is moderately difficult.

Not only for that pitch, but for most of the climbing on the Matterhorn, the climber has to have the use of both hands; it is out of the question to give up one of them just to hold a lantern. Whatever illumination is provided, therefore, must be carried in the mouth.

The old school climbs its rocks, as well as walks along its paths, with a candle lantern; the new school uses an electric flashlight. There are disadvantages to both. The candle lantern burns nose and chin alternately, and the cooler flashlight, an awkward thing to hold in the teeth for two hours, interferes somewhat with conversation. Nevertheless, I held a flashlight in my mouth until dawn.

Although we climbed as hard as we could, our progress was slow because of the large quantities of fresh snow and ice still remaining on the rocks. We reached the Solvay Hut at 7 and waited for an hour there.

Photograph by Miriam O'Brien Underhill

HE MUST LET GO AT THE NEXT STEP!

As the climber slides down the rope on the Grépon, his body swings in toward the wall. Lest his hands strike painfully against the overhang, he must cast loose all holds and grab the line again.

Photograph by Miriam O'Brien Underhill

THE ORDINARY ROUTE UP THE JUNGFRAU IS JUST A WALK UP STEEP SNOW AND ICE!

Starting from the middle of the bottom edge of the picture, the line of footsteps can be plainly seen running diagonally upward to the Rottalsattel, a saddle between the Jungfrau (right) and the Rottalhorn (center). From there the route scales the final slope of the Jungfrau. The black specks in the center and on the track (about an inch and a half from the bottom) are four climbers. The Aletschhorn looms on the far left.

MATTERHORN DEVOTEES DO THIS IN THE DARK

About 15 minutes above the Matterhorn Hut, the rock climbing begins. The author's party passed this spot at 3 a. m. the day of their successful attempt (see text, page 169). Here Jessie Whitehead clings like a fly to a ledge one morning when snow foiled the party.

Photographs by Miriam O'Brien Underhill

FRESH SNOW AND LOOSE ROCKS MAKE TRICKY FOOTING

As Jessie Whitehead and Alice Damesme pick their way up the ascent just above the Matterhorn Hut, they must be careful lest they dislodge blocks upon the heads of those following. The white drifts, unusually deep, conceal bad surfaces and occasion extra caution.

Photograph by Miriam O'Brien Underhill

TO ENJOY QUIET AT LUNCHEON, TRY THE MATTERHORN

After conquering the steep snow slope on the left, the climbers pause on the Swiss summit, and the photographer snaps them from the Italian. At least 39 alpinists have lost their lives assaulting this dangerous giant. On the fateful first ascent by E. Whymper, July 14, 1865, four men of his party of seven were killed. Descending after their victory, one man slipped, dragging three of his companions over the brink. When the rope linking them to the others broke, they crashed 4,000 feet to a glacier below.

The weather was definitely turning bad. We had had ample experience in recognizing the signs of approaching bad weather and they were all there. We felt, however, that the storm might, perhaps, hold off for just a little while, and we would attempt a quick dash toward the summit, now not so very far away.

SO NEAR AND YET—LIGHTNING!

We climbed for about an hour longer and reached the Shoulder, that snow-covered projection just below the final rise to the summit. Here at last there was no escaping from the bad-weather portents. Great black clouds were rolling up out of Italy before us, and if we looked the other way we could not avoid seeing a snowstorm raging on the Weisshorn.

Obviously we ought to turn down; an exposed ridge at 14,000 feet is no place in which to be caught by a thunderstorm. To stay on the crest of the ridge itself would be to run a very real risk of being struck by lightning; to drop down on the wall below the ridge would be to get in the path of falling rocks.

Still, there were all those other people keeping on, twenty-four of them, strung out all along the ridge. We were not the only ones who had been waiting for weeks for good weather to climb the Matterhorn. Not a single party had turned back!

Since the others, guides and amateurs alike, obviously thought it proper to continue, who were we to set our judgment above theirs?

However, the presence of other people on a mountain does not keep lightning away; and I, for one, am timid in the face of objective danger. Though it took great independence and courage, we felt, thus to oppose public opinion, we turned back.

Promptly three-quarters of the others turned around, too! Our error dawned on us. We had misinterpreted the continued upward climbing of the other parties. They had kept on not because they considered it the proper thing to do, but because, being men, they could not admit defeat until we, the two girls, did!

How tiresome was the climb down in mist and cloud and driving snow! The rocks were wet and cold and our hands, too, were wet and cold. It was hard to see the route, and the tracks we had made coming up in the morning were covered by the falling snow. Furthermore, when ropes get wet they stiffen and twist and become unmanageable. And I am afraid we were a little discouraged! It was getting near the end of the season, and Jessie had only a few more days before sailing home.

Five days we waited in Zermatt, and on August 19 we made our fourth trip to the Matterhorn Hut. Jessie says there is not a mule in Zermatt that does not recognize her.

Kronig had reserved the best mattresses for us by placing our crampons, points up, in the middle of them, as we had directed him to do on the first good day. I am afraid there is no "news value" in saying that the next morning it was snowing.

Admitting then that the season was over, we departed, taking all our equipment down with us. We made arrangements with Kronig, however, to spend the entire summer of 1932, *en pension*, paying our board by the month, in his hut, until we should climb the mountain. Kronig considered this rare humor.

THE MATTERHORN AT LAST!

In 1932 things did not start in any better. July was bad in the Alps. It was well into August, I think, before any party managed to get up the Matterhorn or almost any of the other big peaks of the Valais.

Alice Damesme and I (Jessie could not get across that year) waited around Chamonix for days, at the end of July and the first part of August, hoping to do a training climb or two before going to Zermatt. But it rained and snowed, and we finally went away for some manless climbing in the Dauphiné Alps: the Pic des Pavéoux and the Tour Carrée de Roche Méane.

The day after accomplishing the Tour Carrée, Alice and I started for Zermatt. The Matterhorn, by this time, we felt, must be in good condition. We passed the night of August 12 at the Matterhorn Hut—it has been suggested that I write a book on my 1,001 nights in the Matterhorn Hut—and the next day climbed the mountain.

Although there was a great deal of snow and ice on the rocks, especially above the Shoulder, and a crowd of people showering down clouds of snow on one another, we found no insurmountable difficulties, and we reached the summit at half past 8. It

Photograph by Lincoln O'Brien

THE AUTHOR'S MOTHER WATCHED HER CLIMB THE MATTERHORN

Herself a mountaineer, Mrs. Robert Lincoln O'Brien took keen interest in following the progress of her daughter. Almost the whole route is visible from the village of Zermatt. The guide, Bernhard Biner, is here explaining that an apparently bad storm is just a "local disturbance."

was a beautiful day, warm and sunny, but with a few little clouds that suggested that the weather might not stay that way forever.

The Matterhorn has two summits—the Swiss, 14,692 feet high, and the Italian, some forty-three inches lower (as determined by Swiss engineers!). These two are connected by a narrow ridge about 260 feet long, and one should visit both, if only for the stupendous views down the Italian side, at the time of our ascent deeply snowed under. Alice and I tarried for two hours on these two summits before starting down (see page 162).

The descent was slightly more difficult, because, of course, the snow had become softer with the action of the sun and much of it showed a tendency to slide away, leaving bare ice underneath. We put on our crampons, therefore, and wore them down to the Solvay Hut, treating this part as an ice climb instead of a rock climb.

The signs of bad weather increased, and the last hour down the rocks a little flurry of snow overtook us. We were well used to that, however. Never in three experiences have I come down that lower part of the Matterhorn *except* in a snowstorm!

I should have gone back to Chamonix with Alice, where our friends among the French climbers had prepared an elaborate reception at the railroad station, with enormous bunches of flowers, a "band," and "orations," in honor of the first women to climb the Matterhorn alone, but instead I drove over to do some guideless climbing—not manless—in the Eastern Alps. As a result, this story was temporarily interrupted.

STALKING ANTS, SAVAGE AND CIVILIZED

A Naturalist Braves Bites and Stings in Many Lands to Learn the Story of an Insect Whose Ways Often Parallel Those of Man

By W. M. Mann

Director, National Zoölogical Park, Washington, D. C.

TO WRITE the word "ant" in Japanese, you take the character for "insect" (to the left, below) and add to it "unselfishness, justice, and courtesy" (center). Then you have the character (on the right) which means "ant" and also shows the flattering Japanese opinion of it.

This delightful compliment is most interesting and many species undoubtedly deserve it; yet there are ants as savage and ruthless as the ancient Huns or Mongols—ants that devote their lives to foraging in vast armies, destroying the nests of others, and killing all insects and animals in their way (see Color Plate VIII). There are queen ants that enter a foreign colony, ingratiate themselves with the citizens, foully murder the true queen, and usurp her place. There are ants that raid the nests of their neighbors and kidnap their young as slaves (see Color Plate I).

GROW GARDENS AND KEEP "COWS"

Some, high in the scale of ant civilization, make their own gardens and grow their own special food. There are ants that keep "cows"; others that gather and store honey in barrels made from living nest-mates; * still others that use their own young as spools of silken thread in making nests (see Color Plate IV).

In sheer numbers, too, the ants challenge imagination. Their legions outnumber those of every other land creature in the world, except possibly some minute forms of life. So far, some 8,000 species, subspecies, and varieties have been collected and painstakingly classified—a different kind of ant for about every word of this article.

* See "Living Casks of Honey," in this issue of the National Geographic Magazine.

The immense amount of work devoted to studying ants in all regions of the world bears witness to their magnetic appeal to the interest of man.

Thus there have been published monographs on the ants of Madagascar and of New Caledonia; catalogues of the species which inhabit Brazil, Chile, Switzerland, Connecticut, and the peninsula of Baja California. One huge volume concerned with the ants of the Belgian Congo alone contains 1,139 pages.

Even the ants that crawled on the earth three million years ago live again in the pages of voluminous books, because their bodies happened to be entombed and preserved in the flowing resin of prehistoric pines, now known to science as the "Baltic amber."

LIKE SHIP LIFE AND HEATED HOUSES

Of these incredibly numerous and interesting creatures there are certain to be colonies on your lawns; there may be a nest or two in the rafters of your home and almost certainly some in the vicinity of the kitchen. Each colony of a species contains from a few to many thousands, even hundreds of thousands, of individuals.

The common little yellow house ant, *Monomorium pharaonis,* takes readily to life on shipboard, and so has traveled to all parts of the world (see Color Plate II). It takes kindly, also, to heated houses, and so, although a tropical ant, it thrives in northern countries and has become a pest everywhere.

One of our lawn ants, *Lasius niger,* in its several varieties spreads itself throughout the entire Northern Hemisphere, where it damages the golf greens of Washington, D. C., as impartially as it does the temple gardens of Japan. It is one of the most abundant single species of insect (see Color Plate II).

Some warm day, preferably after a shower, find a nice, flat stone on a sunny

hillside and turn it over. There probably will be an ant nest beneath it—a series of channels leading from one cavity to another (see illustration, page 190). Worker ants rush about, excited at the sudden uncovering of their home. One, very much larger than the others, is the queen, or there may be several of them if the colony is a large one. If there are males, and they are present only during the mating season, they are usually much smaller than the rest, generally dark in color and wearing large wings.

Piles of larvae and pupae, a few of them unusually big and destined to become females, will be whisked below out of sight while you are watching. If you look closely, you may see the eggs, little clusters of tiny white specks adhering together. The "ant eggs" of commerce are not eggs at all, but pupae of the large red ant. The cocoons, from which adult ants soon would emerge, are gathered in large quantities in Europe and dried and exported, to be used as food for goldfish and captive soft-billed birds. At the Zoo we sometimes put a few of them in the custard fed to the anteaters.

HONEYDEW ON ANTS' MENU

In our nest under the stone there may be one or more reddish beetles stalking slowly about among the ants. These are guests or parasites. Often they have a strange hold upon the affections of their hosts. They beg liquid food regurgitated from the communal crop, or storage stomach, of the ants, which sometimes so neglect their own young to pamper these insidious spongers that the colony becomes debilitated and dies out.

On the roots of plants in the passages there may be plant lice, or aphids and coccids, the "cows" of the ants (see illustration, page 197). As the weather gets warmer, the lice will be taken out and "pastured" on the roots of other plants, sometimes on Indian corn, where they do much damage to the farmers' crops. In this case, ants are an accessory to the fact. It is the aphid that does the harm, but the damage is greatly exaggerated by the ants' tender care.

By a stroking process similar to milking, the ants obtain from the plant lice a highly valued food substance, honeydew. This is the sweet sap of plants after it has been sucked out and passed through the bodies of the tiny insects, most of which take more than they can absorb.

As this forms the chief food of many ants, they tend and protect their cows as conscientiously as do any pastoral people. Sometimes they even build sheds of carton, a papery substance, on the trunks of trees to shelter them. At the approach of cold weather the ants sometimes gather them into their nests on plant roots, taking them out to pasture again when the danger of frost is over and their proper food plants are growing. A common sight about Washington in the spring is a troop of ants tending aphids that are feeding on the stalks of our common roadside weeds.

Examine carefully the nest under the stone on the hillside and you may find the home of another ant there, an almost microscopic yellow species (*Solenopsis molesta*), sometimes called the thief ant.

Making a nest adjoining that of a larger species, it tunnels into the larder of its neighbor and aggravatingly helps itself. The passages are so small that the big ants have no more chance of chasing their tiny tormentors than a man would have of pursuing a marauding rat into its hole. Uncovering two such nests sometimes precipitates a battle in which the larger ants get their long-sought revenge. The thieves can only cling annoyingly to their big opponents, which they do until bitten to death.

Break open a rotten log and a colony of a different kind may be revealed, with workers less excitable (see Color Plate II). Slowly and methodically they move their young away from the disturbance.

MARVELOUS RESOURCES OF THE QUEEN

Under a deeply imbedded rock you will perhaps discover a small family of the Troglodyte ants, blind dwellers in the dark, remaining motionless to avoid detection.

All ant colonies have one point in common. The members, excepting, of course, guests, parasites, and other intruders, are all children of a widow queen who has left the home nest on her nuptial flight. After mating high in the air, the male always dies, as he falls to earth far from the home nest and is helpless without workers to care for and feed him. The female, however, has marvelous resources within herself, and all alone she establishes a home and a family of her own.

After fertilization the queen creeps into some cranny beneath bark or under a stone;

Photograph from Topical Press

A GOOD TEE-SHOT FROM ATOP A GIANT TERMITE HILL

Scores of natural hazards have been erected by the insects on this strange nine-hole golf course at Elisabethville, in the copper-mining region of the Belgian Congo (see illustration, page 175).

sometimes she constructs a small shelter of crude paper made by chewing bark from a tree. Now she lays her first eggs. During the time when she was a larva and a newly hatched female in her home nest she had been constantly cared for and even pampered by the workers of the parent colony. Special foods were given her, and she was able to lay up in her body a considerable surplus. Her wing muscles were enormously developed for just this one flight. Fat was stored in her abdomen.

From now on there is no further use for wings, so she scrapes or bites them off. The wing muscles disintegrate and add to the stored-up food which she is able to feed her first babies by regurgitation. The first hatched are runts and weaklings, but ants, nevertheless. Their instinct is fully developed and they go to work collecting food for their mother and for their new and constantly appearing sisters.

An ant colony has been created. The queen, her troubles over, becomes a mere egg-laying machine, carefully fed and protected by her children.

Mating flights of ants are common in the spring and midsummer, when hosts of males and females swarm into the air. Crowds of them are seen emerging from cracks in cement walks, on lawns and in gardens, and at this time of year the entomologist receives many letters asking about these "flying ants" and usually enclosing a specimen, folded and badly crushed, in the envelope.

Although practically all ant colonies are founded by a lone female, there are some

Photograph by Ernest G. Holt

TERRIBLE SCOURGES OF LEAF-CUTTING ANTS DESTROY THE LIFE-GIVING CROPS OF SÃO GABRIEL

The legions of Brazil's insatiable saubas have raided the gardens of this lonely village on the Rio Negro so often that the natives must depend upon a few banana plants, a patch of sugar cane, and a little cassava. But for the bounty of forest and river, the inhabitants would starve. The leaves are not eaten by the ants, but are used in growing their "mushroom" food (see Color Plate V and text, page 192).

Photograph from Topical Press

A GOLFER'S NIGHTMARE IS THE "ANT HILL" COURSE IN CENTRAL AFRICA

Natural bunkers as big as houses rise on every hand. They are termite nests—120 of them—guarding the fairway like mountains in miniature. Some are even used as tees, although it takes considerable climbing ability to get to the top. The man at the right, with two black caddies near him, has sliced into one of the insect-erected hazards. American greenskeepers, bothered by the castings and sand cones of common ants (see Color Plate II), may consider such trials as these and take heart.

extraordinary exceptions. One is Carebara, an ant of Asia and North Africa, noted for being a great enemy of the "white ants," or termites, on which it feeds (see Color Plate VI).

A RETINUE FOR HER HONEYMOON

When the mother-to-be Carebara goes on her honeymoon, a number of the almost microscopic workers attach themselves to her legs by their jaws, and in this way are with her to be of help when she starts the new colony.

Extraordinary and somewhat piratical methods of establishing colonies are followed by the females of some ants, usually species not physically capable of caring for their own first brood. One kind steals into the nest of a related species, hurriedly seizes and makes a pile of the pupae already there, and fiercely defends them from their rightful owners. When adult ants emerge from these pupae they are loyal to their kidnapper mother and, antlike, commence to care for her eggs and for the young hatched from them. This results in a mixed colony of two species.

A few species of Western ants of the genus *Formica* have very small females, thickly covered with soft yellow hair. Entering a colony of another, though closely related, species, they so ingratiate themselves with the workers that they are adopted and the rightful queen is murdered by her own progeny, who devote the rest of their lives to the new queen and her young. The original inhabitants eventually die off, leaving their native nest entirely in the possession of the usurper and her brood.

THE QUEEN IS MURDERED!

In North Africa a fertile queen of the "decapitating ant" (*Bothriomyrmex decapitans*) will fly to a nest of Tapinoma, a much larger ant, and loiter around the entrance until Tapinoma workers seize her. They take her into the nest, but for some reason do not eat her; whereupon she climbs onto the back of the rightful queen and saws at her neck until the head falls off. Then the Tapinoma workers adopt her and care for her eggs and young until the nest is populated only by the offspring of the regicide.

More males and females are produced; queens fly away, find another nest of Tapinoma, and repeat the process. One wonders how the host species has persisted so long, but it may be that it will eventually be exterminated by the decapitators; then the latter must disappear also, for such a parasite cannot exist without its host.

Certain ants have gone so far in parasitic development that the worker caste has entirely disappeared, leaving only males and females incapable of caring for themselves and entirely dependent on their ability to find nests of suitable host ants. Some fifteen genera of these have been discovered.

When the Amazon queen goes out to found a colony or "queendom," she enters a nest of the common Formica and immediately pierces the head of their queen with her long, curved, and sharp-pointed jaws. She is then adopted by the Formica workers, who devote the rest of their lives to caring for her progeny.

The Amazon, with its lethal mandibles, made only for fighting, is incapable of feeding itself or performing the ordinary home duties of an ant, so the supply of slaves has to be replenished from time to time by raids on neighboring Formica nests (see Color Plate I).

The hard-working defenders, with their short, triangular mandibles, are no match for their well-armed foes and the battle is always one-sided. It is interesting to see the Amazons, sometimes in more or less regular file, bearing home the captured pupae from which new slave ants will emerge. Later the captives occasionally help raid their old nests and enslave their own sisters.

The Amazons occur throughout the temperate regions of the Northern Hemisphere, rather rarely in eastern United States, but commonly in parts of the West. I have found them only twice in the vicinity of Washington, D. C., on the edge of Soldiers' Home Park and on Bull Run Battlefield, curiously enough.

THE "FORGOTTEN ANTS"

One feels sorry for some of the industrious species of Formica, solid citizens, but really the "forgotten ants," because they seem to be preyed upon by every sort of warrior ant and their nests are nearly always shared with various guests and parasites.

Two kinds of ants, very different from each other, sometimes live together amica-

Photograph by Jacob Gayer

BRAZILIANS FIGHT ANT ENEMIES WITH SMOKE

In Belém (Pará) leaf-cutting pests are killed by pumping sulphur fumes into the nests (see Color Plate V and illustration, page 174). The can at the left contains a charcoal fire. It is placed over the entrances and the pump at the right does the rest.

bly, each occupying a separate part of the same nest and contributing to the general welfare.

The little shampoo ant (*Leptothorax emersoni*), discovered by Dr. William Morton Wheeler, of Harvard,* in the peat bogs of Connecticut, lives in the nests of *Myrmica canadensis*, a much larger species. When the Leptothorax worker needs food, it approaches the Myrmica worker and proceeds to shampoo and lick it. The Myrmica obviously enjoys this, for it regurgitates food to the Leptothorax.

One day in Brazil I was investigating an ant nest consisting of a mass of earth six inches in diameter in a fork of a tree. I tapped this nest gently with my forceps and the surface was immediately covered with small, reddish-brown ants of the genus *Dolichoderus*. When I gouged into the nest to find the various forms, a swarm of Odontomachus rushed out and one of them stung me. Odontomachus was a dozen times as big as the Dolichoderus and provided with strong biting jaws and a red-hot sting.

Undoubtedly the little Dolichoderus had built the nest and the Odontomachus had taken up their abode there also. Evidently a small insect alighting on such a nest would attract only the smaller inhabitants, but a severe jolt would bring out the shock troops in defense. Both of these ants were new to science and never have been found again.

THE THRILLS OF AN ANT HUNT

Often I have gotten as big a thrill from a successful hunt for a rare ant as I have from the capture of giraffes or wart hogs. There is about as much physical exertion involved, too, turning over thousands of stones and logs, digging into the earth, chopping hard wood, and peeling bark from innumerable dead trees.

Luck frequently plays an important part. In 1901 Father Schmitt, a Jesuit missionary, sent to the great myrmecologist, Forel, of Switzerland, a single specimen of a new and extraordinary ant from Haiti. Forel described it and named the genus

* See "Notes About Ants and Their Resemblance to Man," by William Morton Wheeler, in the National Geographic Magazine, August, 1912.

after his good friend, Carol Emery, of Bologna, and the species after the Jesuit (*Emeryella schmitti*). This lone specimen was long the only representative of its kind in collections, and the species was something I especially wanted to find while in Haiti (see Color Plate VI).

At the end of a month's work I had found one solitary worker along a roadside. I had no fine-tooth comb with me, but for two months I tried every other method I knew of to discover the nest or more of the workers. Finally I reported to my teacher in zoölogy that, as far as I could make out, the species was now extinct and I had captured the last survivor on the island.

Then one evening I went for a stroll just before dinner and noticed on the path a millipede, or thousand-legger, moving in an unnatural way. Bending over, I saw that the millipede was dead and was being carried by an ant. The ant was *Emeryella!*

It took all of my strength of character to keep from seizing both ant and prey at once, but I smoked my pipe as calmly as I could and watched the ant till it leisurely entered a small hole at one side of a flat stone.

When the stone was turned over, there was an entire colony of some sixty workers. Later, in the same locality, I found a similar colony, and specimens of these have now been distributed to all the important ant collections in museums all over the world.

There were no females in either nest; so it is not improbable that this species lacks a special female, and that one of the workers functions as an egg-layer. At night there came to lights in my quarters a reddish ant, which from its general character we assume to be the male of the species and have so described it.

I had talked about *Emeryella schmitti* so much that it became well known to the scant white population of the island under the name of "Mary Ella Schmitt," and when I finally reported its discovery there was a great celebration among my fellow Americans, railroad men vacationing at Port-au-Prince.

Another missionary priest, Père Sallé, had sent to the Museum in Paris from Haiti a curious nest of vegetable fiber, not unlike a wasp's nest.

Forel, while rummaging about among the specimens, found it and tapped it on a piece of white paper. Several dead and dried ants dropped out. They belonged to the genus *Macromischa*, the most exquisitely formed of the ants and with beautiful metallic coloration—purples, greens, and reds (see Color Plate III). The genus is interesting, too, because it alone of the ants of the West Indies has developed into numerous species. About thirty are known from Cuba alone.

I remember one Christmas Day at the Mina Carlota, in the Sierra de Trinidad of Cuba. When I attempted to turn over a large rock to see what was living underneath, the rock split in the middle, and there, in the very center, was a half teaspoonful of brilliant green metallic ants glistening in the sunshine. They proved to be an unknown species of this genus.

FINDING A "LONG LOST"

One of the "long losts" was *Macromischa sallei,* in Haiti, and my heart was set on finding it again. Coming into Furcy one afternoon, mounted on a diminutive Haitian horse, I saw an ant walking across the road. It was *M. sallei.* I collected it and put it carefully into a vial of alcohol.

Père Plombé, most genial of hosts, greeted me and announced that dinner was nearly ready. On the little ridge where the church and priest's house stood were low bushes belonging to the genus *Baccharis.* While waiting for dinner I strolled among them and noticed an oval object on one of the bushes. I tapped it with my forceps and the next moment the thing was literally covered with ants. They were *M. sallei* swarming out to defend their home.

Other bushes contained other nests, and I shall not forget the thrill I had when I told Père Plombé, on my return to his home ten minutes later, that I had rediscovered this species and had enough specimens for all the museums in the world.

Père Plombé in his profession meets all sorts of people with all sorts of enthusiasms, but my elation over this find puzzled him a little. He gazed at me, then at the vials densely packed with ants, shook his head, and murmured to himself, "C'est curieux!"

The fire ant (*Solenopsis geminata*) is such a good traveler that one variety or another is found throughout the warmer parts of the earth (see Color Plate II). It gets its name from the painful, burning sting it can inflict. A colony contains

© National Geographic Society

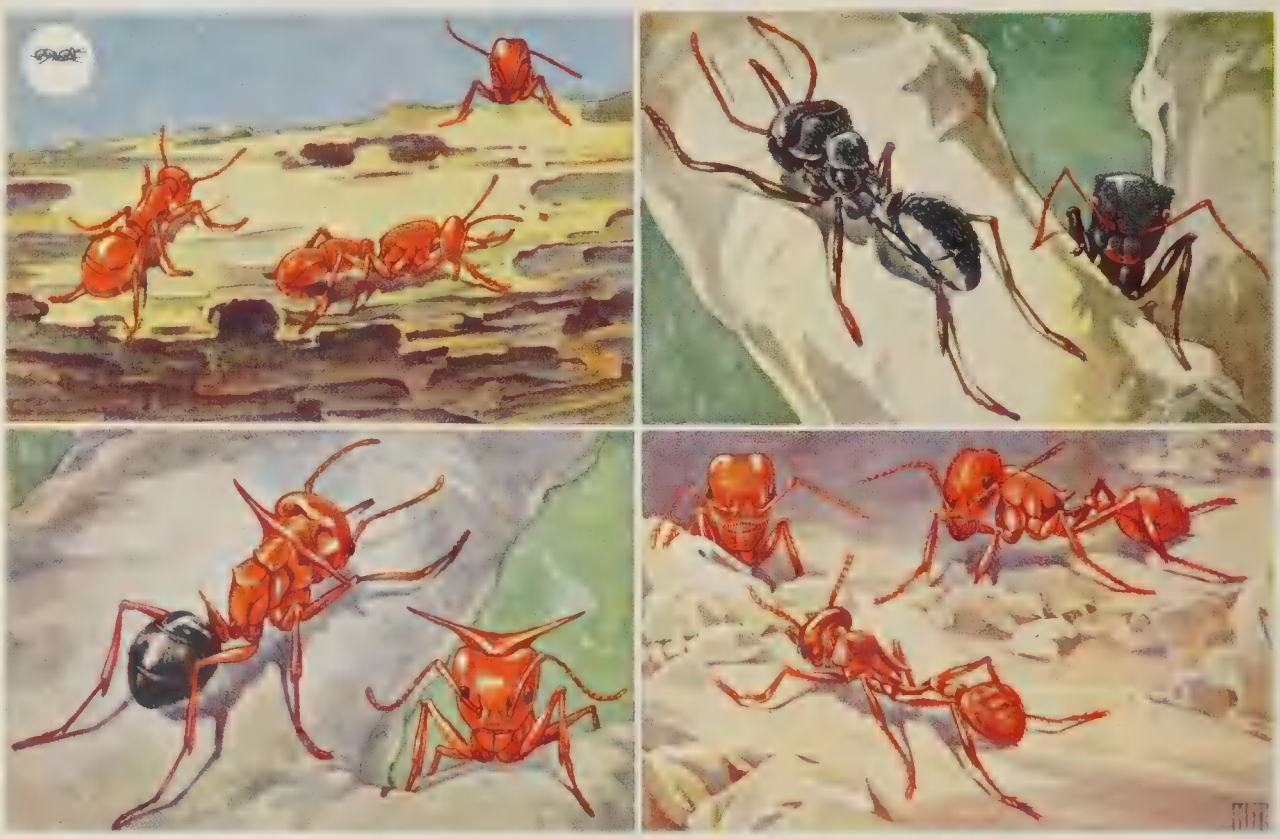
(Inset, natural size)

RED AMAZONS WITH ICE-TONG JAWS DEAL DEATH IN A KIDNAPPING RAID

One drives the twin prongs through her black foeman's head. Others grapple or poise for the kill. With duller jaws, the desperate blacks (*Formica*) gnaw their enemies' legs, but some of the reds dart into the nest and bear off the booty—fat pupae from which black ants will emerge to become their slaves. Without them these Amazon ants (*Polyergus*) of the United States, Europe, and Japan would die, as their weapons are so long and sharp they can neither feed themselves nor care for their young. The Geographic's staff artist peered through microscopes for months to make these remarkable action paintings.

"PUBLIC ENEMIES" SPOIL PUTTS, LOOT PANTRIES, STING LIKE HOT NEEDLES

Among the world's most abundant insect species are the lawn ant, bane of golf courses (left, *Lasius niger americanus*), and the tiny, yellow house ant (*Monomorium pharaonis*, upper right, stealing sugar). The southern and tropical fire ant (lower right, *Solenopsis geminata*) carries a burning sting.



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(Insets, natural size)

A PRIMITIVE UNITED STATES ANT "PLAYS POSSUM" WHEN ATTACKED

This sluggish dweller in rotten wood is *Proceratium croceum* (upper left). On the tomb of Haiti's black king, Christophe, Dr. Mann discovered *Camponotus cristophei* (upper right), hence its name. South America's rare *Dolichoderus spinicollis* (lower left) has horns, and the Texas harvesting ant (*Pogonomyrmex desertorum*, lower right) wears a beard in which it carries sand in nest-digging.

THESE SLENDER BEAUTIES OFTEN WALK WITH THEIR HINDQUARTERS REVERSED

Delicate in sculpture and striking in hue is *Macromischa purpurata*, found by Dr. Mann in the West Indies. It feeds on small insects or plant nectar, nests in hollow twigs, and works without the energetic haste often associated with ants. The legs are long but the pace is slow.

© National Geographic Society

(Insets, natural size)

A BIG, HOMELY FACE MAKES A LIVING DOOR

The soldiers of *Camponotus* (*Colobopsis*), left, living throughout the world, have oversized, curiously indented heads. With these they block the round entrances to their nests in the hollow stems of sedges, as one is doing here, and open only at the proper "password"—a series of antennae strokes. A blind, primeval Australian ant is *Eusphinctus steinelli* (right).

© National Geographic Society

(Inset, natural size)

TAILOR ANTS, LIKE MEN, HAVE MASTERED THE USE OF TOOLS

Their own young are used as spinning machines in nest-building. While some of the long, vicious, red workers (*Oecophylla smaragdina* of the Old World Tropics) yank the edges of growing leaves together with their tusks, others pick up half-grown larvae with well-developed silk glands for spinning cocoons. Stimulating the grub with its antennae, the tailor makes it produce a silken thread which sticks to the leaves and binds them together. These ants bite so ferociously that they often leave their heads in the wound when brushed off. In India, men pound the ants to a paste which is eaten with curry. Wearing the wings of their marriage flight are the queen and the smaller male.

© National Geographic Society

(Small inset, natural size)

AT NIGHT OR ON CLOUDY DAYS, SWARMS OF LEAF-CUTTING ANTS STRIP WHOLE TREES

Pieces of leaves are sheared off with their saw-edged jaws (inset, upper right) and carried home like waving banners by workers marching in wide columns and beating regular paths. Then the leaves are chewed to a paste, on which later grow the "mushrooms" that form the only food of these ants (*Atta cephalotes*, of tropical America). They do immense damage to orange groves. Large and medium ants serve as leaf gatherers or soldiers. The smallest, riding on the leaf in the center like a mahout on an elephant, acts as gardener for the fungus, or works in the nursery. Known as sauba ants in Brazil, they are fried and eaten by Indians.

A HUNTER RETURNS, ALL BUT HIDDEN BY ITS PREY

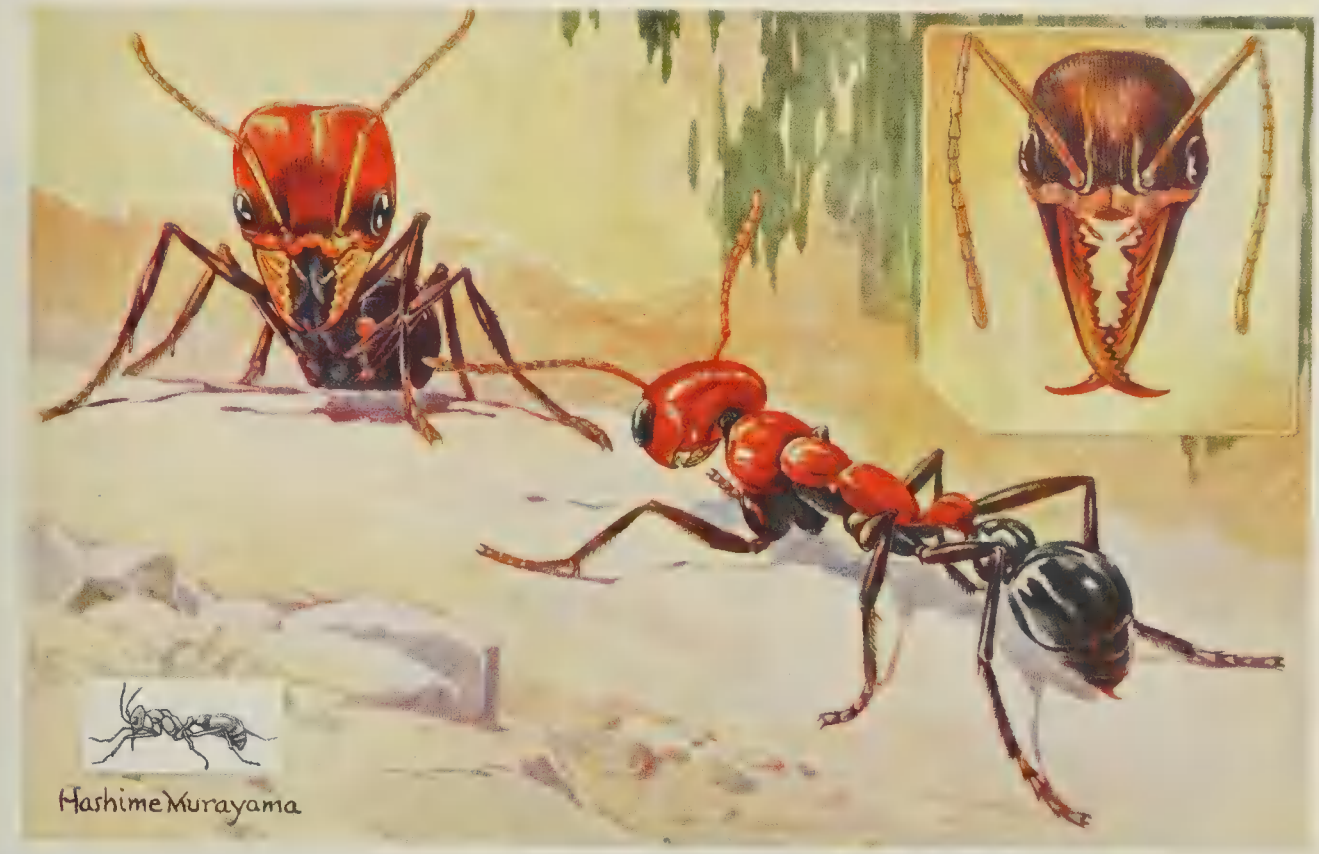
To the home nest under a stone, a worker of *Emeryella*, of Haiti, brings one of the millipedes which form its chief food. A comrade displays the powerful jaws with which it seizes its quarry. The actual execution has been done by rapier thrusts with a sting. A winged male sits on the stone.

© National Geographic Society

(Insets, natural size)

THE "WHITE ANT" WHICH RIDDLES WOODWORK IS NOT AN ANT AT ALL

Instead it is a termite (*Reticulitermes flavipes*), related to the cockroaches. Perpetrators of great damage in tropical countries, these wood-eaters have recently become a menace to buildings in many United States cities. Here in the royal chamber sprawls the egg-laden queen. Beneath her is a young female facing a winged male. The others are workers and big-jawed soldiers.



FAR FIERCER THAN ITS NAMESAKE IS AUSTRALIA'S BULLDOG ANT

Routing many a picnicker and scientist, it grabs with strong, saw-toothed jaws, then drives in a sting a quarter of an inch long, partly visible at the rear of the nearer one. These well-armed fighters —*Myrmecia fornosa* and (inset, upper right) *Myrmecia nigriventris*—are among the largest of ants.

© National Geographic Society (Small insets, natural size)

THE CARPENTER ANT WEAKENS HOUSES, BRIDGES, AND TREES

Like the termites (see Color Plate opposite), it bores elaborate tunnels which sometimes cause beams and rafters to collapse without warning. The thick-jawed wreckers (*Camponotus herculeanus pennsylvanicus ferrugineus*) have been found frequently in the eastern United States. On a log crawl a winged male, workers, and soldiers with large heads

© National Geographic Society

(Inset, natural size)

AGAINST THE HUNLIKE HORDES OF ARMY ANTS NO LIVING THING CAN STAND

Even men flee as the mighty column writhes through the jungle, wiping out all insect and animal life in its path. Like generals, colonels, and captains at intervals in this line of destroyers (*Eciton hamatum*) march the biggest ants with such long, sharp-pointed hooks for jaws that they have to hold their heads up. With the army come camp followers—guests and parasites superficially resembling ants. Just this side of the twig that serves as a bridge is a beetle. Nearer, in line with the head of the caterpillar, which has been bitten and stung to death, creeps a masquerading wasp. The hovering fly is believed to lay eggs and larvae on the heads of ants, the grubs then killing the hosts.

vast numbers of workers. They have recently been reported as doing great damage to young quail in the Southeastern States. The birds, incapable of defending themselves, are stung to death.

Fire ants nest in almost any kind of locality and are extremely prolific. Even floods cannot daunt the fire ant, for it has been reported in Brazil that when the water rises and washes out a colony, the ants form a ball, queen and brood in the middle, and this living ball floats away to a tree or to higher ground, where the ants recommence housekeeping.

THE TAILOR ANTS USE LIVING TOOLS

The tailor ant (*Oecophylla smaragdina*) and a few other ants (*Polyrhachis*) are unique among all the earth's creatures, so far as we know, in that they use their young as tools in nest construction (see Color Plate IV).

Few adult insects spin silk, but the larvae of many have this ability to enclose themselves in silken cocoons, from which they will later emerge as fully formed adults. Oecophylla utilizes this accomplishment of its young in making its nests.

I have often torn one of the leaves that formed its box-shaped nest and then watched the proceedings.

At first there is a wild sortie on the part of the ants, all in fighting mood. They cannot sting, but they bite annoyingly.

After they have given up trying to find and destroy the intruder, worker ants seize larvae in their mandibles and bring them to the damaged portions. Other workers seize the edges of the leaves and pull them together, while those with the larvae pass them back and forth, stimulating the grub to exude silk, which sticks and holds the pieces of the leaves together.

After their silk has been used for the common good, the luckless larvae have to sleep naked!

The tailor ant lives throughout the Old World Tropics and is one of the few ants that are greenish in color, though some of its varieties are red, and one, in West Africa, is brown almost to black.

COLLECTING FROM TREE TOPS

In the Solomon Islands this pugnacious Oecophylla abounds. On the island of Malaupaina I had for two weeks the unusual and delightful good fortune for a naturalist of being able to collect among the tops of high trees. A plantation company was felling the original forest, clearing the land for coconuts. One enormous tree after another was felled, and as soon as it came down I would go among the upper branches and collect.

Oecophylla was abundant, and I can safely say that there was scarcely a moment of daylight during those two weeks when an ant was not biting me on the neck. I would instinctively reach up, seize the little creature, break its neck between my thumb and forefinger, and go on collecting.

But once, as I crushed one of them, I noticed that it was unusually hard. It was another ant, a Podomyrma, rare and desirable. After that it was necessary for me to seize each attacking ant and carefully examine it before destroying it, so as not to crush a valuable specimen by mistake.

Eight thousand different kinds of ants are a large order, but students have simplified their study by a classification which is one of the finest that has been done for any insect group. They have been arranged into different families, and the first and most primitive of these are the Ponerines, the ant savages. Like cavemen, they live solely by hunting. Big, strong jaws run in the family and at the other end they carry a poisonous sting. Their headquarters are the Tropics, but a few forms extend into the colder climates also. Some are minute in size, but others, the largest of the ants, attain a length of more than an inch and have antagonistic dispositions more than worthy of their bulk.

In Bolivia we found that one kind, nearly an inch long, locally called "buni," but classified as *Paraponera clavata,* would sometimes actually drive the bare-footed natives from their own corn patches.

PROMENADING IN THE FOREST

A still larger species, the "great, terrible ant" (*Dinoponera grandis*), the "tucandero" of the Brazilians, also inhabits tropical South America. At Belém (Pará) every day we could see individuals an inch in length, black and shining, walking unconcernedly along the path in the forest.

One primitive group includes the bulldog ant of Australia, which gets its name from its powerful biting jaws; also it has a sting so efficient that it inspires respect (see Color Plate VII). There are many species, and they range from a third of an inch to more than an inch in length. Some live

Courtesy Dr. W. M. Wheeler Photograph by J. G. Hubbard and Dr. O. S. Strong

EXCITED ANTS DASH ABOUT AT A COMING-OUT PARTY

A new generation is making its début. Pale, callow workers (*a*) have just emerged. In the two large cocoons (*b*) are future queens. The smaller casings will yield workers. These common ants of the Northern States, *Lasius* (*Acanthomyops*) *claviger,* keep herds of plant lice (see illustration, page 197).

beneath stones; others make mound nests, and they forage all over the place.

The Australians are very fond of picnicking. I remember on my first visit there, when we would go out for a day our place for luncheon was carefully selected, usually in the center of a broad sheet of Hawkesbury sandstone, not because this rock was particularly soft, but because of its vantage as a lookout for bulldog ants.

The Ponerines usually hunt singly, but with their formidable armament they are able to subdue insects much larger than themselves. A few hunt in groups and raid nests of other ants or of termites.

In Africa I have seen such raids made by a black hunter, *Paltothyreus tarsatus.* The workers are about three-quarters of an inch long. Marching in an orderly, though hurried, column some twenty feet in length, they enter a termite nest. From the surface there is no evidence of a struggle, but after several minutes the column streams out of the ground, each worker holding a dead termite in its jaws.

Termites (see Color Plate VI) form the chief food of many of these Ponerines. Sometimes they establish their colonies in the termite nest itself, somewhat apart from the rightful owners, but still near the source of their living food supply.

In Bolivia I found in a decayed log a populous nest of termites and in the same log was a colony of red hunter ants (*Centromyrmex*). In the chambers of the ants' home I noticed on the top of each larva the body of a decapitated termite. Near by were little piles of dead termites to provide a second helping.

ARMY ANTS ARE LIKE MONGOL HORDES

If these Ponerines, living in small colonies and subsisting by hunting, may be compared to such primitive peoples as the Australian aborigines, the Ituri pygmies, or the Carapuna Indians, then the next group, the Dorylines, or army ants, may be likened to the Mongols of Genghis Khan, traveling in countless hordes (see Color Plate VIII).

Blind workers of different sizes, marching in efficient, ruthless military formation, they leave a wake of death behind them. Nothing in their path is safe. Holes in the ground are entered, tall trees are climbed, and even human dwellings invaded in search of insect prey.

Some raid only the nests of other ants for the larvae and pupae on which they live; some seem especially fond of cockroaches; and I was once driven out of my forest hut by a swarm of these ants pouring up over the door-sill log like a black Niagara flowing the wrong way. I sat outside for hours, until the invaders eventually left, carrying with them what looked like pounds of dismembered cockroaches, spiders, and other late but not lamented fellow housemates of mine.

Different species of these driver, or legionary ants, inhabit all of the continents, but they are most abundant and the armies are largest in the Tropics. Our North American species, some of which range as far north as North Carolina, are small and often subterranean in habit.

EVEN THE ELEPHANTS MAKE WAY

In Africa and in South America roam the mightiest legions. It is said that even the elephant will get out of their line of march, and that the anteater itself might find them too much of a good thing. Certainly, any living creature that becomes covered with these biting, stinging demons is in a pathetic plight. As they are blind, the size of their quarry means nothing whatsoever to them.

Once, in Africa, I leaped into a stream after carelessly stepping into a file of ants. A dozen or so of the vanguard had already clamped onto my leg and kept stinging me, even under water, until I plucked them off.

The number of individuals in a big horde of these marauders cannot be estimated. The column may be an ant or two wide, or it may be over a foot or a yard wide. One army stayed in the vicinity of our camp in Bolivia for weeks, so that I came to feel well acquainted with it as a whole, though not individually.

For hours I sat alongside and watched the column flowing along, waiting for the curious parasitic beetles that live with the ants and accompany them on their march. The beetles so closely resemble the ants that it required experience to single them out in the rapidly moving procession.

When one came along at last—one that I saw—I would grab at it with my forceps. Then a terrific commotion would result. Flanking columns hurried out to find who was molesting them, so I would retreat ingloriously and wait until the column of blind investigators had reorganized itself before resuming my watch.

FORMING A LIVING BRIDGE

Several times I have seen the army form a bridge across a rivulet. In doing this, numbers gather in a mass on the edge and cling together; others venture out; still others closely intertwine their legs till an elongated mass of living ants is extended across; then the army passes over, using this bridge.

I could not find out how the bridge was broken up, because night would come with the file still crossing. Neither could I locate the other end of this file, and I still think of it as marching endlessly and eternally through the Bolivian forest.

In the American Tropics legionary ants are encountered on every walk in the woods, yet the discovery of one of their queens is an entomological event. The female is wingless, an ungainly creature, blind like the workers, her abdomen greatly enlarged.

There is no permanent nest, though some species make temporary ones in the ground and remain there till the hunters have

Drawing by Hashime Murayama

THE THRIFTY ANT OF THE BIBLE STILL LABORS NEAR JERUSALEM

Thousands of years ago an ant, probably of this species *(Messor barbarus)*, caught the attention of King Solomon and inspired his immortal advice: "Go to the ant, thou sluggard; consider her ways, and be wise." Here she "gathereth her food in the harvest" by carrying to her nest a grain of millet locked in her jaws.

Photograph courtesy Dr. W. M. Wheeler

THE STREETS OF AN ANT CITY ARE KEPT SCRUPULOUSLY CLEAN

A flat stone has been removed and the well-ordered nest of a very common ant, *Lasius (Acanthomyops) latipes*, stands revealed. In the interest of sanitation and unimpeded traffic, all food refuse, empty cocoons, dead ants, and débris are carried off to veritable kitchen middens some distance from the living apartments.

thinned out the near-by fauna, reminding us of the yearly hunts of the ancient Mongols. Then the whole colony migrates, taking with them the larvae and the queen.

Sometimes, during the heat of the day, they cluster in a hollow tree or some other depression, a huge swarm of ants, sometimes a bushel of them in one close mass, with brood and female in the center for protection.

With them may also be found the parasites, usually beetles or wasps that superficially resemble the ants. In watching the file one may see one of these inquilines every several minutes, or one may not notice one for an hour. The capture of a swarm, with dozens or hundreds of them at the same time, is to the collector nothing less than a gold mine. He is certain to get badly bitten and stung, as he breaks up the mass and searches for the prizes, but it is worth it.

LONG LIVES THE QUEEN!

The one duty of the queen is to lay eggs, and this she does almost continually, the colony increasing in number and in strength. She may have a long life, for there is one record of a queen confined in a glass observation nest who had survived for 17 years, and I once saw a 14-year-old queen who had spent her life in the collection of a friend of mine in England.

The tasks of housekeeping, nursing the babies, and gathering food are left to the worker, the undeveloped female. Contrary to general opinion, only a small percentage of workers are actually out of the nest at any one time. At home they spend much of their time in grooming themselves and each other.

Most ants subsist entirely on liquid food. Even the pieces of insects which they eat are taken into the mouth cavity and the liquid pressed out and swallowed. The dry pellets are spat out. These hard pellets, by the way, sometimes are used as food by other insects which share the nest with the ants.

ANTS HAVE MILLERS TO GRIND GRAIN

Naturally, in a colony of many thousand individuals a large amount of food is consumed. It has been estimated that a single nest of the large mound-building ants of Europe, practically the same as those we find throughout our Far West, collects each day insects to the number of several hundred thousand.

The harvesting ants, most of them inhabitants of deserts, have developed millers, with heads enormously enlarged to contain the muscles of the jaws.

The ordinary worker goes out day after day and brings in seeds of plants. These the millers laboriously grind into a sort of flour, which is stored in the nest.

Once in Arizona, while collecting ants, I noticed a small turret entrance to a nest. Around this were a number of mammoth ant heads. Later I found that these were the heads of the millers. The harvesting season was over. The millers had done their duty in grinding the grain; whereupon the workers, provident always, had sawn their heads off. It was more economical from the standpoint of the colony to raise a new brood of millers next year than to carry these over during the times of depression.

From the train window the traveler in the Southwest sees large ant hills dotted over the desert. These are usually nests of the bearded agricultural ants, Pogonomyrmex (see Color Plate II). They live on the seeds of grasses which they gather and store in their nests. There is usually a large area kept carefully cleared about the nest, which makes the mound stand out prominently. Sometimes surrounding these cleared areas is a fringe of the grass that supplies the food of the ants.

From this, some observers have thought that the ants intentionally plant their own food. This is probably not so. Refuse from the nest is carried out and deposited at the edge of the clearing, and with this refuse may be some of the seeds which germinate there. It is thus by accident that a source of food supply appears adjacent to the nest.

These desert harvesters are fierce in the defense of their home, and it is said that small children have been stung to death while playing on the nest. I have been stung a number of times while collecting Pogonomyrmex and can testify that the sting leaves a dull pain which lasts for some time.

Honey ants are another example of those that look ahead to the days of famine, piling up quantities of honeydew in living containers (see text, page 193, and illustrations, pages 194 and 195).

The fungus-growing ants, chiefly inhabiting tropical America, but also extending into the Temperate Zone as far north as New Jersey, actually plant and cultivate their food. They belong to a distinct group, called the Attinae, and all they ever eat is a little mushroom which they themselves grow.

Any evening, on a walk in southern Texas or in practically any part of tropical or subtropical America, one will see files of these ants, each ant bearing a bit of leaf. For this they have been called "parasol ants" and "leaf-cutting ants" (see Color Plate V and illustration, page 174).

One species is a terrible pest to citrus planters in the Tropics. The colonies are enormous. Sometimes an orange tree will be stripped of leaves in a single night.

The ants carry these leaves into their nests along well-beaten trails. There they are chewed into a paste by the smaller workers. This paste is used as a stratum on which to grow the minute mushrooms on which the ants live. The smallest members of the colony serve as gardeners as well as nurses and take care of the crop. For fertilizer most of them use leaves, but some use bits of straw, and others caterpillar droppings, on which to raise the fungus.

The queen ant, before she leaves her parent nest, takes into her mouth some spores of this fungus. When she lays her first eggs she crushes them and deposits these spores upon them. The fungus starts and maintains itself there until her second crop of eggs develops into young ants, who go out at once to obtain new food for the home garden.

TERMITE IS KIN TO COCKROACHES

There is an old saying that termites are called "white ants" because they are not white and because they are not ants. A true ant is a relative of the bees and wasps; the termite is kin to the cockroaches. But these two groups, so widely different in origin, have developed somewhat similar ways of living. In termites we have the differentiation into soldiers and workers, and we have the sexual forms, males and females (see Color Plate VI).

The latter, however, pair for life; so, instead of the widowed queen that we have in the ant nest, we find in the termites a king and a queen. Their method of establishing the colony is essentially the same. There are flights when the air is filled with flying white ants, their wings dropping off much more easily than do those of the true ants.

I remember one occasion in the Solomon Islands when such a flight occurred while we were at dinner, and we hastily withdrew from the vicinity of the lights in order to keep our soup from being entirely wings. These, however, are not mating flights, as in the ants, but are distributional flights. Pairs go out, find a suitable place, and commence housekeeping together.

Like the ants, termites build various forms of houses, mounds, and tree nests, but often live in the heart of the tree itself. Their food consists almost entirely of wood, which they chew up and swallow, but some of them raise fungus, reminding one of the fungus-growing ants.

With one or two exceptions, they are denizens of the dark. Exposure to heat causes the death of most species immediately.

They are much more injurious than ants. In certain tropical countries the termites' habit of destroying books makes it difficult to maintain libraries. Even as far north as Washington, D. C., it has been necessary to replace floors in the National Museum and other public buildings on account of the depredations these insects have committed.

Ants, like man, live in complicated societies. They recognize fellow citizens only by their odor, and any that do not smell the same are enemies.

Ants have an intense patriotism, evinced by their willingness to fight and die for the home nest; and a touching devotion to their mother and to the babies in the nest. They are, for the most part, hard workers, and each individual does its utmost to contribute to the general welfare. They build complicated homes, and they show a wise providence in the storage and preservation of food.

The joker may say, also, that the ant has attained complete perfection in one field: the women do all the work.

On the other hand, there are among ants morons, paupers, and other parasites; thieves, ingrates, murderers, and kidnappers.

So, in reply to a question which has been asked me in all seriousness:

"Which is the more intelligent, man or the ant?" I feel inclined to reply:

"It depends on the man—and the ant!"

LIVING CASKS OF HONEY

By Jennie E. Harris

EACH year thousands of people visit the Garden of the Gods, in Colorado. They stand in awe before fiery-red pinnacles etched against blue sky. They marvel at those fantastic rock formations—the gods of mythology, with their human shapes, some of their hats, most of their spears, and a few of their cathedral spires, towering about them in red sandstone; and they are unaware, these interested sight-seers, of an ancient, dramatic "*civilization*" living under their feet.

Yet here, in the sandstone ridges, dwell creatures who might themselves have stepped from living myths—creatures with yellow heads and large, inflated, translucent bodies—who are, perhaps, the most self-sacrificing beings known.

In fairy tales boys and girls are fattened by witches, so that they may later be eaten with gusto. In this race, dwelling in darkness in the Garden of the Gods, children are fed enormously, so that a few may become overcapacious and hang in underground cellars for months, for years, as living casks of honey.

This would be terrifying were these creatures human. Instead, they are honey ants.

Honey ants are unhuman and unlike any other insect in their translation of themselves into honeypots.

They gather a honey not unlike that of bees and store it in round, thin casks that let the beautiful amber of honey shine through. But the casks possess living trunks, living heads, living legs. They hang by living claws to the cellar roof, and open a living spigot when an imbiber comes to drink (see illustrations, pages 194 and 195). For this, children are fed to enormous size and chambered in eternal darkness.

TINY BEINGS DO PRODIGIOUS EXCAVATING

Here and there, across the tufts of grama grass and wild sunflower heads, gleam little mounds of red sandstone and bright-colored quartz—craters cut into rock. The red, loose stones roll out on all sides to a diameter of about thirty inches, with each mound rising to three or four inches, pierced by a large central entrance hole.

Outside, all looks simple; but inside, a descending shaft runs vertically for a while before carrying off sharply to a long gallery and other shafts, forming galleries under galleries, all running in the same direction. Then, seldom far from the surface, usually up or down a few steps from a main gallery, single or in suites, are the wine cellars, the honey chambers, the forever-homes of the swollen members of the race.

It would take a Gustave Doré to portray adequately the drama of honey ants.

The honey chambers where they hang are virtually death chambers, except that life flows from them freely. The severed casks of honey in the burial grounds form a nightmare thing, cask rolled beside cask. But beauty exists in the ants' refusal to touch a honey cask after its owner has died. The little crammed honeypots stand idle and untouched, once they are rolled into the cemeteries.

VISITING THE ANTS' HOME

Be an Alice in Wonderland in such a home, if you will. Come down that wide central stair, having ducked into the rabbit hole, passed sentinels at the gate, and given the essential salute. All is dusky dim; only that glimmering round of daylight above. You turn left down a long, narrow passage, which leads into deeper and deeper darkness; but the floor glints up with a firm polish—the floor deliberately made smooth, not merely worn smooth by the passing of innumerable feet. And the walls are smooth and straight, a sort of guide in the dark.

Little feet rustle by—ants laden with earth, excavating a new room far at the end of the passage. All that mound above was formed by similar excavations; each pebble, each shining bit of quartz, was carried along galleries up the main stairs and out.

"Um-m-m!" An ant licks her mandibles, giving off a vague sweet scent. Honey! Somewhere near is a honey cellar. The ant has paused in working to take a good stiff drink. A shaft descends darkly to the left; cautiously down, down, to a great vaulted, globe-lighted room.

The vaulted roof is clustered with enormous hanging lamps. No, not lamps; pale amber spheres, hanging about midway into the room, occupying half the cellar space. The globes glow with the light that lives in honey; their pale-gold color is the richness

Drawing by Murayama, after H. C. McCook

THE PASSWORD GIVEN, A HONEY CASK OPENS THE FAUCET

Hungry workers flock around their balloonlike sister and swallow the sweet liquid regurgitated from her huge community stomach. By this unique storage system the honey ants *(Myrmecocystus hortideorum)* of Colorado's Garden of the Gods tide over the season when food is scarce (see illustration, opposite page).

of honey; that scent rising from them is the warm flavor of honey. Each globe is a living jewel, nothing more nor less than the distended body of a living ant, filled almost to bursting with limpid honey, clutched to the roof by its claws.

They crowd the arched ceiling; stir restlessly; twist their yellow heads, squirm their shoulders, but do not loosen hold. Below them the clean walls slope to the level floor, which is swept, polished, made smooth. But the roof is gritty, purposely left rough, for the claws to maintain perch.

The roof arches half again the height of the walls; a cellar made deliberately for honey casks, to allow free passage beneath, space for keeping the honey casks clean and the cellar free from mold.

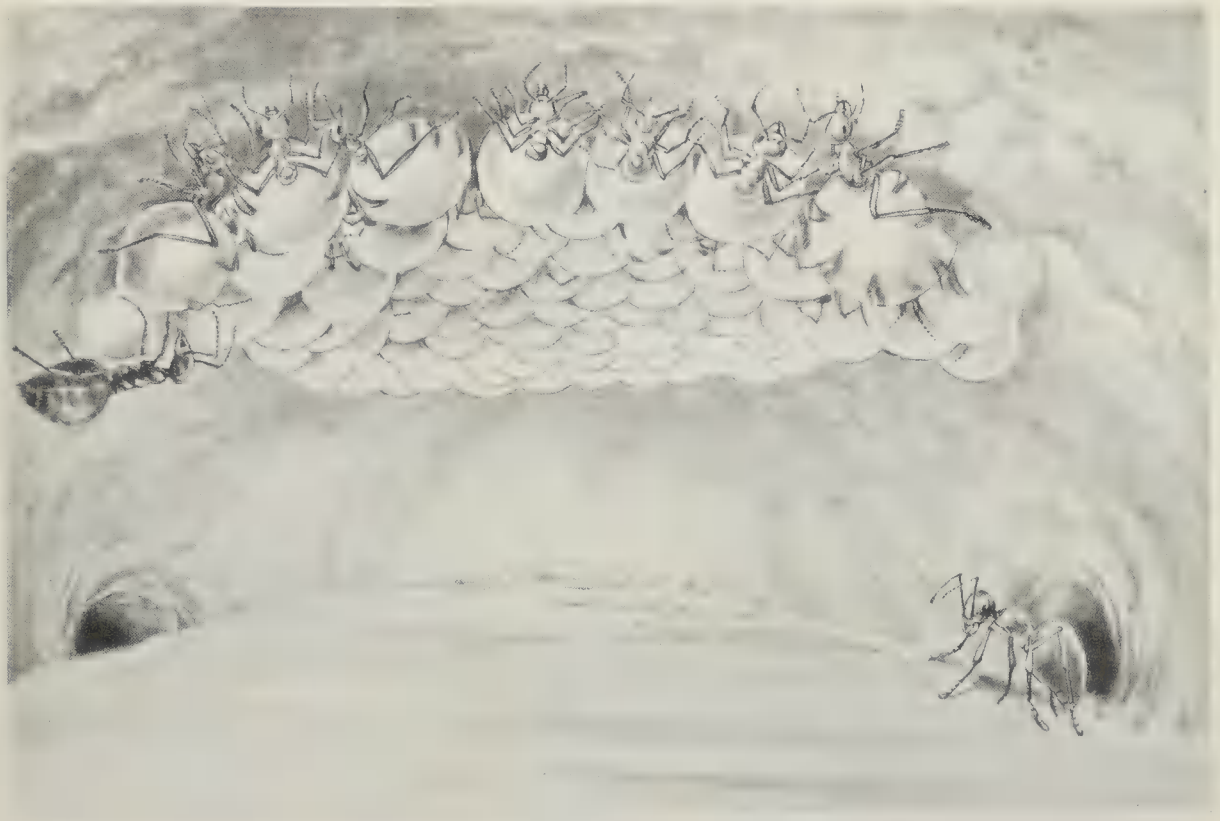
There are little soft sounds, as the great globes stir, shift an arm or foot, sway a little nearer to a neighbor. "Careful! Don't dare lean. You might break me!" And one turns a pointed yellow head toward another's. The globes are not all clear amber. Queer dark planes streak them. Their translucent part is inner skin stretched to balloon proportions, pushing apart the dark planes of the outer body, forming islands on a globe map of strange world seas.

SPIGOT MOUTHS OF LIVING HONEYPOTS

Suddenly an ant enters to drink. She looks like these hanging ants, yellow-headed, yellow-waisted, but she wears no inflated balloon. Her antennae lift inquisitively. Already the foretaste of honey is in her mouth. She stands almost erect, climbs to the hanging ant, leans to its little closed mouth. "Open, please." Obediently its mouth opens. Up comes a clear drop of honey, pushed up by some inner movement, to hang a moment, glistening, on the cask's lower mandible, before dropping into the waiting ant's mouth.

She takes one, two, even three, drops. "Thank you; you may close." She climbs down, and the little spigot mouth closes. Before the ant leaves she daintily wipes her mouth against the back of her hand, smooths down her back hair, then trots off, groomed, well fed.

Another ant enters; another, another. Each climbs to a chosen sphere; says, "Open, please," with that leaning of mouth



Drawing by Murayama, after H. C. McCook

HONEY-FILLED "REPLETES" MAY CLING TO THE CEILING FOR THEIR LIFETIME

Equipped with commodious, elastic crops, the ants that are to become honey casks crawl to the vaulted roof of the storage cellar, get a good grip, and let the workers fill them almost to bursting with the sweet discharge from oak galls or living aphids (see page 199). Then they function as living food reservoirs, yielding drops to hungry workers on demand.

to mouth, and at once the mouth opens and up comes the honey drop.

But suppose they enter to deposit honey rather than receive it. What then? Painfully, slowly this time, because so laden they are almost honey casks themselves, the ants climb to the hanging casks, place mouth to mouth. "Open, please," and, with antennae held back out of the way, let drops of honey form on their mandibles to enter the obedient casks.

This new honey is almost white in its freshness. As long as drops are there to fall in, the little spigot mouth holds open. Then the emptied ant, relieved, turns away; and the globe, clinging to the roof, gleams larger, more bulbous still, with the added contents. It scarcely dares draw a full breath, move an arm, or shift a leg for fear this new weight and fullness will make it burst or fall.

Poor little doomed creatures! What determined such a fate? When young, they resembled other ants. They had the same two stomachs—one private, the other for communal use. Much that entered their mouths they never tasted, for it passed at once to the communal crop, to be fed later to the queen (whose duties are like those of a queen bee); to males (resembling drones in a hive); to workers, or to baby ants. But some showed an enormous capacity for food. How they begged, their pale mouths open all the time! Now these are honey casks.

Late dusk in the Garden of the Gods. The sandstone gods are cold and dark. They have had their play of light all day, while the red mounds of the ants stayed quiet, with gates closed. Seemingly all inside were asleep; yet few ants slept, being busy, most of them, with underground tasks.

Now ants push out of that round tubular hole so fast they cover the mound. If this were daylight, no red rock would shine. Yellow ants are everywhere, by hundreds, by thousands.

A NIGHT SORTIE IN QUEST OF HONEY

A ring of sentinels begins pacing the outer edges of the mound. Others guard the gate, their heads thrusting up, like sol-

Photograph by Will F. Taylor

HOW MANY STORIES IN THIS TERMITE SKYSCRAPER?

The photographer made it twenty-two, but the number varies, depending on the view. Not all "white ants" are wreckers of houses (see Color Plate VI). These in Angola, Africa, are master masons, working in clay, which becomes so hard that the youngster could break it only with an ax. In other regions their architecture runs to spires, monoliths, or huge mounds (see illustration, page 175).

diers with bayonets. Still others move about the narrow platform surrounding the gate, while one ant, then twenty, then a whole column of ants, move off over the ridge, preparing for a march. In the vales between the ridges, far, far away, low scrub oaks, in the light of the moon, thrust up their dark thick leaves. The ants know these dwarf oaks.

They move through straggly bunches of grass on a familiar path, with scant deviation, reaching the oak copse in fifteen minutes. Moonlight pierces the leaves sharply, revealing the ants straddling up the stems, clambering out over leaves, searching endlessly, sometimes fruitlessly, for new oak galls, with their tiny flashes of shining sweet.

A curious insect makes an oak gall and stimulates that flow of oak dew. The tiny creature develops in an inner cell in the gall. When he is extremely young, the gall he lies in is bright, almost scarlet or vivid blue. When he has crawled outside his nursery and lies in the outer sphere, the gall is bright green, soft, about the size of a pea, and bits of sweet stand up about it in tiny flashing dew.

Old red galls, with holes where gallflies have escaped, the ants pass by; but the new pale-green galls, glistening with honeydew, they sniff at, lap the honeydew with delight; then move off to other fresh galls. But after a while they come back to the first gall; after another period, come back again, for new galls exude usually three series of drops in a single night.

The ants started forth at dusk. From midnight till daylight they straggle home. Some are so loaded they can scarcely wabble; others only a little filled; still others empty and unsuccessful.

All night, while they were away, sentinels paced the outer walks. Hungry now, surely; yet surprisingly few sentinels request honey from the filled ants. They only challenge them and cross antennae with antennae in salute. Inside, workers crowd the entrance stairs, begging, relieving the bearers of weighty drops. Honeydew passes from mouth to mouth.

Some workers, amazingly huge, hitch

themselves sidewise to move at all; yet they come up for more and more, clowns skirted with enormous balloons. And the honey-gatherers give to them willingly, knowing here are sisters fast turning into honey casks of their own sweet will.

Babies, too, some of them, keep their little mouths open. Their communal crops, soft and elastic, easily become habitually swollen. Then the surplus honeydew, if any remains, is carried to the dark cellars and dumped into the living honey casks.

WILLING SACRIFICES AS HONEY VATS

When a bee flounders home from pillaging a fresh flower, she pours the bead of nectar into a honey vat near the entrance of the hive, where it is fanned, cooled, its water evaporated, and then stored as honey in a pale waxen cell. But honey ants, laden with a similar beneficial dew, have no power to breathe out wax from their own small bodies; cannot knead wax into cells. So they use certain members of their family as honey vats.

Photograph by Paul Griswold Howes

AN ANT CARRIES ITS "COWS" TO PASTURE

In the herder's jaws and protruding above its head is one of the tiny plant lice, or aphids, which the ants "milk" of their honeydew and move from one plant to another (see text, page 172). On the stalk feeds the rest of the teeming drove. The caretaker in this greatly enlarged photograph is a carpenter ant, often found in the beams of houses (see Color Plate VII).

For months, years, their whole remaining lives, honey casks cling to the vaulted roof of the dark cellar, their bodies dilated to eight or ten times normal size, all that weight of honey suspended by the frailty of tiny claws. Thirty or more honey casks, usually, to a honey cellar; about ten honey cellars to a sizable ant home.

The little swollen things move a little, but seem to lose desire for motion. Once in a great while, one becomes sufficiently empty to be able to unhook itself from the roof, climb down, and even look out the cellar door. In the main they stay filled. If they ever feed themselves, they must open a little inner spigot to let a drop of honey pass into their personal stomach. But they are frugal in the extreme; or else, hanging there so long, so still, they seldom require food. No noticeable portion of the honey they carry is ever self-consumed. In the swelling, the small stomach is pushed far down to the base of the bubble, so that it is doubtful if a honey cask ever eats or drinks.

The power of work has been taken from

them. A few clean themselves, gripping the roof by their hind legs, washing with their middle legs or arms. But a regular delegation of ants comes in to keep them clean, sweep the floor, scrub the walls, and see that the globes stay dry and sweet and sanitary.

The seasons speed; years go by. The only knowledge of time to these little swollen creatures must be that oak galls are fresh outside, for they are given honey today. Or oak galls are old, winter is on them; they must yield honey now.

WHEN DEATH COMES TO A HONEY CASK

Even honey casks cannot live forever. A slender arm becomes paralyzed through that long, tight clutching to the gritty roof. It loses hold; the whole cask falls and strikes that hard, strange floor. It lies with its body projected up by that great ball of itself, its feet and arms waving, its head nodding from side to side. But efforts do no good. It is powerless to rise.

If it falls on something large, it may be able to assist itself back to the roof by scant inches; but usually there it lies. Ants coming in to clean or drink could easily hoist and hoist the honey cask until it could clutch the roof once more. It is in the way; ants must go around it; but they seem not to notice those frantically waving arms, that desperately bobbing head, though the honey cask would grasp gladly, even at a straw. It may lie there for two or three months and be solicitously cleaned and caressed. Its new position is a relief to strained muscles, perhaps, though decidedly uncomfortable. Finally something in its plight shortens its life.

Or, losing hold, falling, the thin cask breaks and the honey spills. There lies Humpty Dumpty, sure enough, feeling all its contents trickle out. Not all the king's horses can restore that honey to the cask. Ants hear the crash, sniff spilled honey, rush in, lap up the oozing sweet in a frenzy of delight. But they disgorge most of the honey into the hanging casks, or rush out with filled crops to feed others.

Sometimes a broken cask will grow together, mending itself, and be hoisted to the roof and filled as before.

At last, after years of holding honey, a honey cask dies. It still hangs to the roof for a day or more, the ants unaware of its death. They clean this cask and others; drink from other casks. Then one climbs to the little closed mouth. "Open, please!" It does not open. What does this mean? Disobedience, unwillingness, in a community where such things are unknown?

Several in turn climb to the tight little mouth. "Open, please!" It never opens; it stays pressed tight. Yet the honey crop is full; its body is a bright amber sphere. They can see the rich honey inside. But at last they realize. The little honey cask is dead.

It takes several ants to handle the corpse. First, the cask part must be severed from the rest of the body. The separation is easy—just a biting through that one narrow connection. Then the cask is rolled through long, dim galleries to the burial ground these ants possess. The claws are unhooked gently from the roof, and the top part of the body is lifted down and carried through the same winding passages in a silent little procession to the same cemetery.

CASKS OF THE DEAD NEVER DESECRATED

And in that gloom of the dead, under the Garden of the Gods, strange gods keep watch. These gods are round, silent casks of honey. Life still lives in them, sustenance is there, food for numerous babies, workers, males, queens. The honey is still sweet and pure. But the ants never desecrate the cask of the dead. It is as if they realize it belongs no more to themselves, but to the darkness and the stillness. In that quiet cemetery, several spheres lie side by side, glowing more and more golden as the honey within them mellows with age.

This honey is almost a pure solution of grape sugar, but it never crystallizes. Its flavor is slightly aromatic, extremely sweet. The honey is limpid, like bees' honey before thickened in the hive. It can be made to evaporate to a gummy mass, but when left in the open it absorbs moisture from the air and becomes liquid honey again.

We owe much that we know about honey ants to Dr. Henry C. McCook. He and his men spent days with chisel and hammer opening a single home, coming carefully upon the used galleries and occupied rooms, taking measurements, making sketches and plaster casts. At one time he found a queen in her room, more than 28 inches below the surface of the hill, over 72 inches from the central stair. She may have dwelt in

that room habitually, or else her attendants, frightened at the strange chiseling, had carried her through hall after hall, as the sounds came nearer, till they reached this far-off circular chamber, where naked babies and some of the workers and honey-bearers had also gathered in their fear.

The gallery leading to this chamber went on sloping for ten inches, ending in a bay-room and a small upcurving hall, the lowest room in the home, almost seven feet out from the main stair, more than three feet below gate level. What depth of architecture for those tiny diggers!

At Dr. McCook's excavating, ants rushed into the cellars, helped the casks down from the roofs, pushed and tugged them to safe places, solicitous about that enormous storage of honey. A large worker would take a portion of that tightly stretched skin into her mandibles and tug and tug, backing out from the cellar into the unbroken hall, and perhaps a small worker stood on the globe and pushed vehemently, though surely she was doing little more than stealing a ride.

Honey ants that were kept in a large glass bottle died in less than three minutes, killed by the sun. Perhaps they are necessarily nocturnal, never daring to venture into daylight. They like sugar, these honey-lovers; but, surprisingly enough, care little for bee honey. At present, honey ants are found in Colorado, New Mexico, and Old Mexico.

Mexicans press out honey casks as one would grapes, and ferment the honey into an alcoholic drink. The swollen casks are really not unlike grapes, their bodies being enlarged from tiny beads to full grape size, to hang like grapes in clusters to the cellar roof.

Commercializing such honey scarcely seems possible. A thousand honey casks filled to the limit would yield barely a pound of honey.

Except for that strange honey-cask custom of theirs, honey ants are rather like other ants. The queen is surrounded by attendants, who groom, caress, and feed her. They form a circle about her as she lays her eggs, then rush these carefully to the incubating rooms, to lick them and keep them warm. Other nurses care for the little things who hatch forth, touching mouth to mouth in feeding. To bathe a baby, a nurse takes it carefully into her arms, turns it slowly while passing her mouth over it. Nurses handle the infants a great deal, turning them frequently, making sure they are warm and well.

The babies are helped in shaping the cradles they spin; are watched over while they sleep in these, to awake as ants and to be cleaned, bathed, and fed until large enough to take care of smaller babies. It is not known what determines which babies shall be princesses (who are bright yellow), which drones (also bright), which workers (pale yellow); but it seems that any worker honey ants who make up their minds can become honey casks.

HONEY ANTS MILK APHID "COWS"

One intelligent custom of honey ants is shared by other ants. They milk aphids for some of their honeydew.

When fresh wild roses scent the Garden of the Gods, honey ants trail toward these instead of toward oak galls. Aphids, those green, translucent-legged creatures who thrust their sucking beaks into roses and thrive on that inner rose dew, draw forth more sweet than they need, the surplus passing out of their backs.

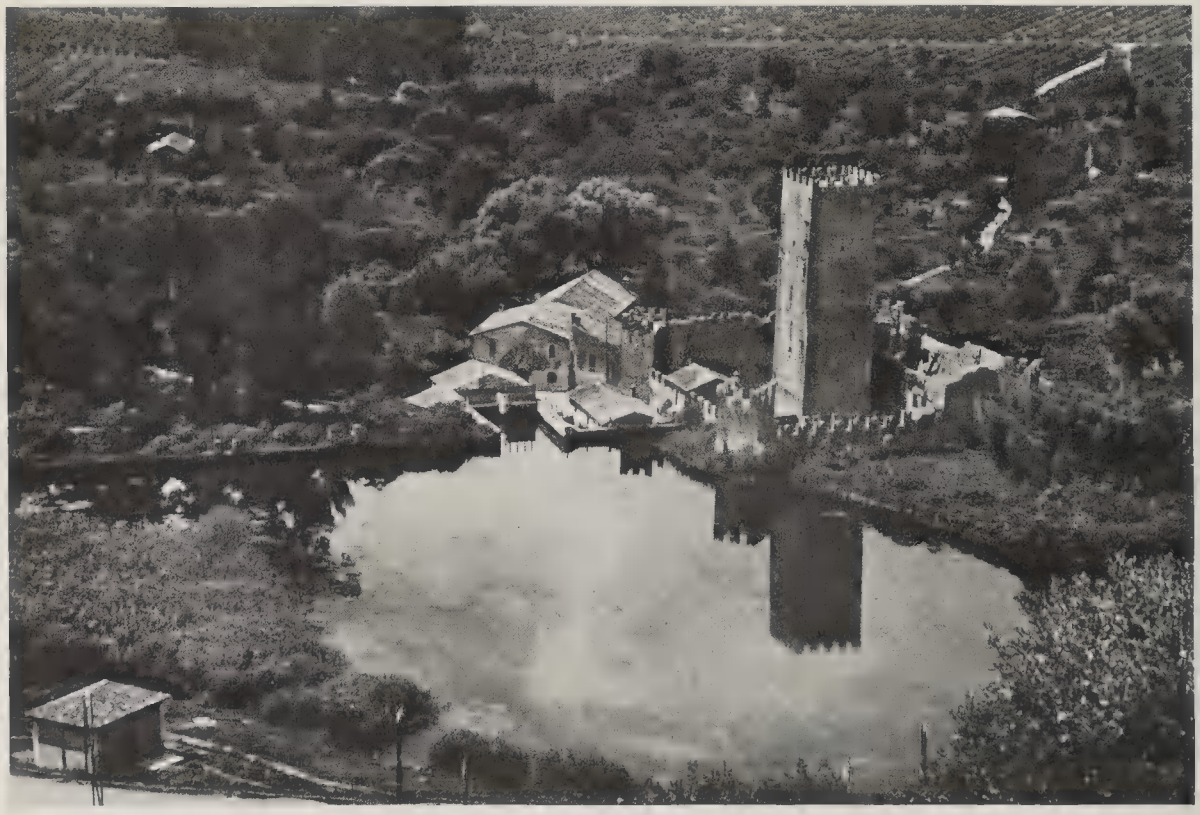
Ants have found this out. Usually among several aphids lies a clever ant. She crawls behind the aphid, gently strokes her sides with first one antenna, then the other, a sort of seesaw motion much like our milking a cow, to which the aphid gratefully submits. And either the aphid's pleasure or else the quiet massaging itself causes honeydew to appear faster and faster on the aphid's rear. The ant laps the honeydew with delight and deposits it in her little inner bucket.

The aphid's body, filled with rose dew, slumps as the ant's body swells. The little green cow even lifts her back to make the milking easy and grazes farther along the rose for more honeydew for the next milker who comes along. Several ants in turn may milk the same aphid. But once in a while a stubborn aphid kicks out her leg and spurts honeydew far beyond reach of an ant's mouth; whereupon the ant probably moves to a more docile cow.

They gain from thirty to forty drops from the same aphid in an hour, go home to empty their little buckets, and then return for further milking. The ants nurse the aphid's young as carefully as their own, and in the spring lead them out to known pastures.

HOME, SWEET HOME, REWARDS EQUALLY PEASANT AND LANDOWNER

From miasmatic, fever-ridden swamp the Pontine Marsh project has created fields amazingly fertile (see page 217) and has equipped the farms with fine buildings, where dwell happiness and health. Vergil would have delighted to sing of the shrewd husbandry of the settlers of to-day.



AMID NEW WONDERS, THE CAETANI TOWER RECALLS THE WONDERS OF OLD

The marshes were partly drained when Rome was at its heyday, and the charming town of Ninfa was known as a center of agriculture. While negligence and the forces of unbridled Nature undid the work of the early reclamation engineers, the buildings fell to ruin. Legend says the lovely maid for whom the place was named took her own life by leaping from the parapet into the lake (see opposite page) and her wraith became the spirit of malaria. These venerable walls, built in the first era of prosperity, have stood through centuries of gloom to welcome a modern transformation.

REDEMPTION OF THE PONTINE MARSHES

By Draining the Malarial Wastes Around Rome, Italy Has Created a Promised Land

By Gelasio Caetani

Senator of the Kingdom of Italy

With Illustrations from Photographs from the Author

THE story runs that a foreigner, traveling through the Pontine Marshes,* asked a shepherd sitting by the wayside: "How do you live here?" and got the reply: "One does not live, one dies."

Two years ago Premier Benito Mussolini gave orders that by October 28, 1935, all the stagnant waters of this region should be drained off to the sea, malaria should be eradicated, 4,000 farmhouses built and populated with as many peasant families drawn from the crowded agricultural provinces of the north, and that three cities should rise in the deserted land: Littoria, Sabaudia, and Pontinia. The waste and flooded plain at the doors of Rome was to become a garden and supply the needs of the capital.

The order is being carried out on schedule time and the project is in first-class shape.

WILD BOARS ROAMED A NEW CITY SITE

Where two years ago wild boars roamed in the broom thickets, you can see to-day the neat city of Littoria, so called to perpetuate this achievement. All the surrounding land is dotted by hundreds of bright, healthful farmhouses, whereas two years ago peasants lived in primitive huts.

Twenty miles to the south, near the sea, Sabaudia, named in honor of the House of Savoy, to which Italy owes its political unity, is growing like a mushroom in the midst of a vast forest that will be its natural park. And at the foot of the mountains Pontinia will rise in 1935, recalling the Etruscan population that, 2,500 years ago, first settled and cultivated this land. This city has not yet been staked out, but the date for the inauguration has been settled.

This astounding transformation could not have been possible had there not been a silent preparatory engineering work. Since 1926 a consortium, with Senator Natale Prampolini, a very capable engineer, at the head, has been working steadily and without beating the big drum. One hundred and sixty miles of road have been constructed, 300 miles of canals excavated, five villages built in the marshy desert, and 270 millions of lire (more than $23,000,000) already spent.

A huge canal, 85 feet wide, gathers the torrential waters at the foot of the hills and, skirting the lowland, leads them to the sea, 24 miles away.

Fourteen thousand men are at work to-day in the region. The hydraulic engineering work has been the indispensable premise to the colonization, an enterprise that has been entrusted to the great war-veteran organization, the Opera Nazionale Combattenti, and to those landowners who have the necessary grit and faith to follow the lead. The veterans will build about 3,000 farmhouses and the landowners about 250.

THE GEOGRAPHY OF THE MARSHES

We must go back in history a little to grasp the general picture. The Pontine Marshes are a rectangular plain, about 175,000 acres in extent, which is hemmed in on two sides by the Lepine Mountains and on the other two by the sea. But along the sea runs a dune three miles wide that prevents the waters from flowing to the sea. The region, therefore, is like a large shallow basin in which the water collects and cannot drain. Between the great dune and the sea lies a series of lagoons.

The old Romans partly solved the problem by digging through the dune a gigantic canal called the Rio Martino.

The pretty legend attached to this name has been told: the legend of King Martino, who, for love of beautiful Ninfa, dug out this kind of Culebra Cut, but was defeated by the magic of the wicked King Moor. The unhappy young lady threw herself from

* See "The Story and the Legends of the Pontine Marshes," by Don Gelasio Caetani, in the National Geographic Magazine, April, 1924.

Drawn by A. E. Holdstock

A SPIDER'S WEB OF CANALS IS THE PONTINE MARSHES' NEW DEAL

Bisected by ancient Rome's "Queen of Roads," the Appian Way, this reclaimed land lies in a hollow depression caught between the Apennines and the sand hills along the Tyrrhenian Sea. Early canals built in Roman times have recently been recut and new ones dug to drain the excess water collected during the rainy season and from springs.

the tower of Ninfa into the adjoining lake and became the evil spirit of malaria (200).

The fact is, that some unknown Roman gentleman called Martinus did the work and succeeded in getting the bulk of the waters to flow out of the lowland to the sea.

However, as the Roman Empire declined and the barbarians invaded Italy, civilization fell to such a low ebb that the noblest knights no longer knew how to scribble their names. So small was the production of writing material that Roman classics were erased from precious vellum sheets to indite the contracts for the sale of pieces of land.

During that period public works were abandoned and the swamps reconquered their kingdom. Pirates roamed freely over the seas and the Pontine coast had to be guarded by strong towers to prevent the

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Natural Color Photograph by Luigi Pellerano

GENZANO LAYS A FRAGRANT CARPET OF FLOWERS TO CELEBRATE CORPUS CHRISTI

Skillful artists first trace the designs with lime water on the pavement. Then, in the afternoon, women bring huge baskets of blossoms and spread the brilliant petals. In the foreground is a religious emblem framed with yellow broom and contrasting red poppies. Next comes the Royal Italian coat of arms, white cross on a red shield, surmounted by a golden crown. Above it, floral artists are completing a picture of an ox and plowman beneath the word "Produrre" (to produce), an invitation to farmers to cultivate the land. As a climax to the festival, a religious procession advances down the avenue of flowers.

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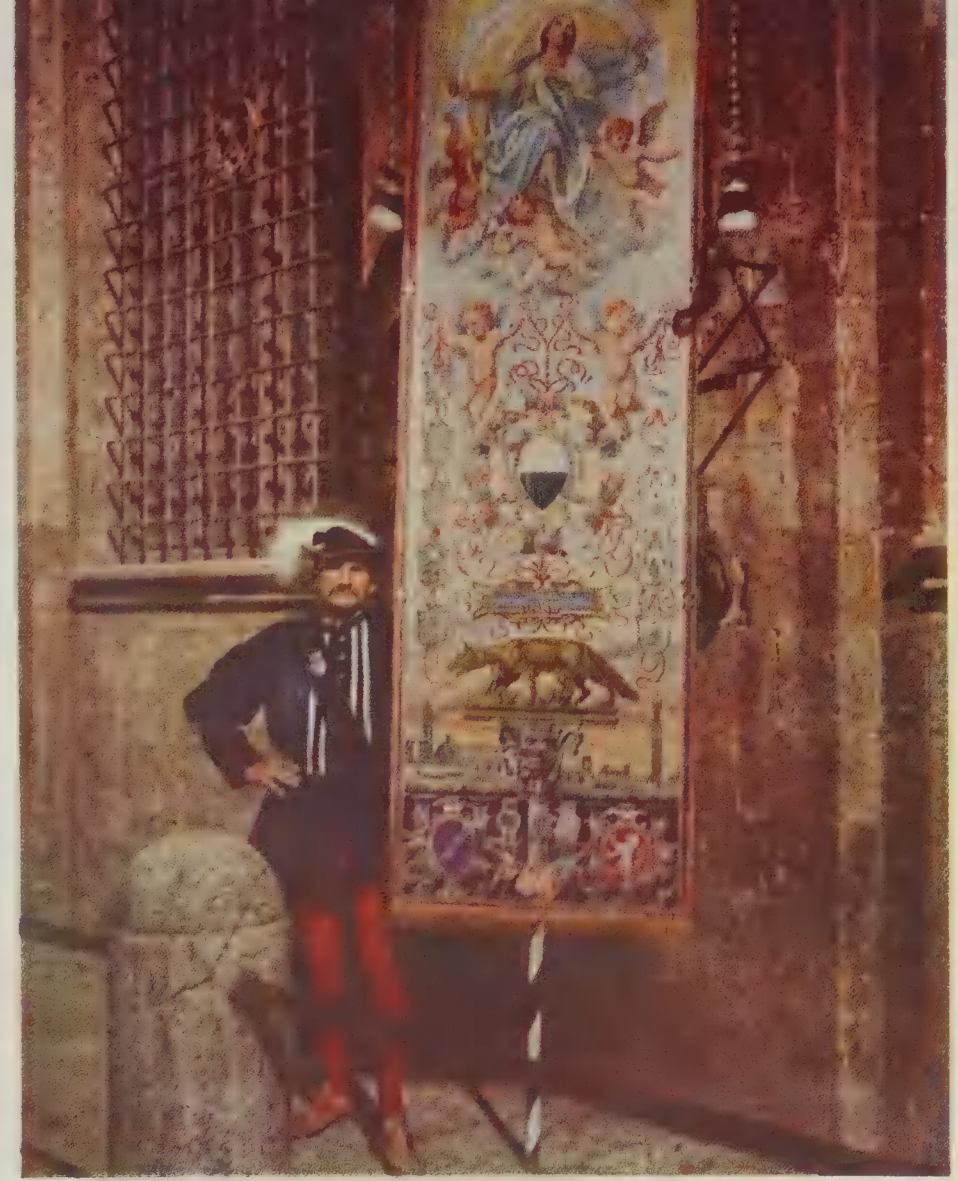
Natural Color Photograph by Hans Hildenbrand

BROODING VESUVIUS WATCHES OVER THE INDIGO MOODS OF THE BAY OF NAPLES

Nearly every visitor to Naples climbs to the gardens of Camaldoli Monastery to glimpse this magnificent sunset scene. Gleaming in rainbow colors, the



© National Geographic Society Natural Color Photograph by Luigi Pellerano

A BANNER-PENNON IS THE PALIO WINNER'S PRIZE

Around Siena's crowded public square, each August, 10 rival horses race and clatter, the jockeys belaboring each other with whips. On the banner appear the image of Santa Maria Assunta, the black and white shield of Siena, and, below the Roman wolf, a panorama of the medieval city.

© National Geographic Society Natural Color Photograph by Gervais Courtellemont

POMEGRANATES FOR SALE ALONG THE ARNO

Crossing the river in giant strides in the background is the historic Ponte Vecchio, the covered upper gallery of which links Florence's renowned storehouses of art, the Pitti and Uffizi Palaces. Goldsmith and jewelry shops project on stilts from the sides of the 600-year-old bridge

THE STORY OF CASTEL SANT' ANGELO IS THAT OF ROME IN THE MIDDLE AGES

Overlooking the Tiber, the round structure, only a skeleton of its former grandeur, was a tomb for some of Rome's most august emperors, a garrison for her defenders against the Goths, and a former stronghold of the Popes. The huge dome of St. Peter's looms against the sky.

© National Geographic Society Natural Color Photographs by Hans Hildenbrand

ROME'S LEGIONS TRAMPED BY SUCH FLOWERED GATEWAYS

For the first 65 miles, the Appian Way, built of lava slabs more than 20 centuries ago, runs straight as a taut string To-day, crumbling tombs of famous heroes and old aqueducts stand in vivid contrast to modern farmhouses The road originally connected Rome with Capua, but later was extended to Brindisi.

LAKE BOLSENA'S EELS WERE MENTIONED IN DANTE'S "DIVINE COMEDY"

To-day, men and boys in strange, triangular boats angle in the blue waters of this circular lake, cupped in an extinct crater—all that's left of a volcanic giant that eons ago blew off its head. Rising above the deep pool are the weathered walls and towers of medieval Bolsena.

© National Geographic Society Natural Color Photographs by Hans Hildenbrand

A VEST-POCKET HARBOR OF CAPRI

Not far from this stony inlet at Marina Piccola rear the fabled rocks from which the Sirens saw "The Winged Galley" bear Ulysses safely by. The island, once a favored retreat of Roman emperors, recently was made a bird sanctuary. Above this tiny harbor a steep, zigzag road leads to the town of Capri.

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Natural Color Photograph by Hans Hildenbrand

THE VILLAS AND HOTELS OF SORRENTO CLING TO HIGH CLIFFS ABOVE AN AZURE SEA

From the balconies of their eyrie rooms, visitors scan the Isle of Capri, looming mistily from the bay of Naples, and watch the busy life of the colorful fisherfolk and bathers on the narrow beach far below. This city also is the rendezvous for those who wish to take the winding and spectacular drive to Amalfi, or glide

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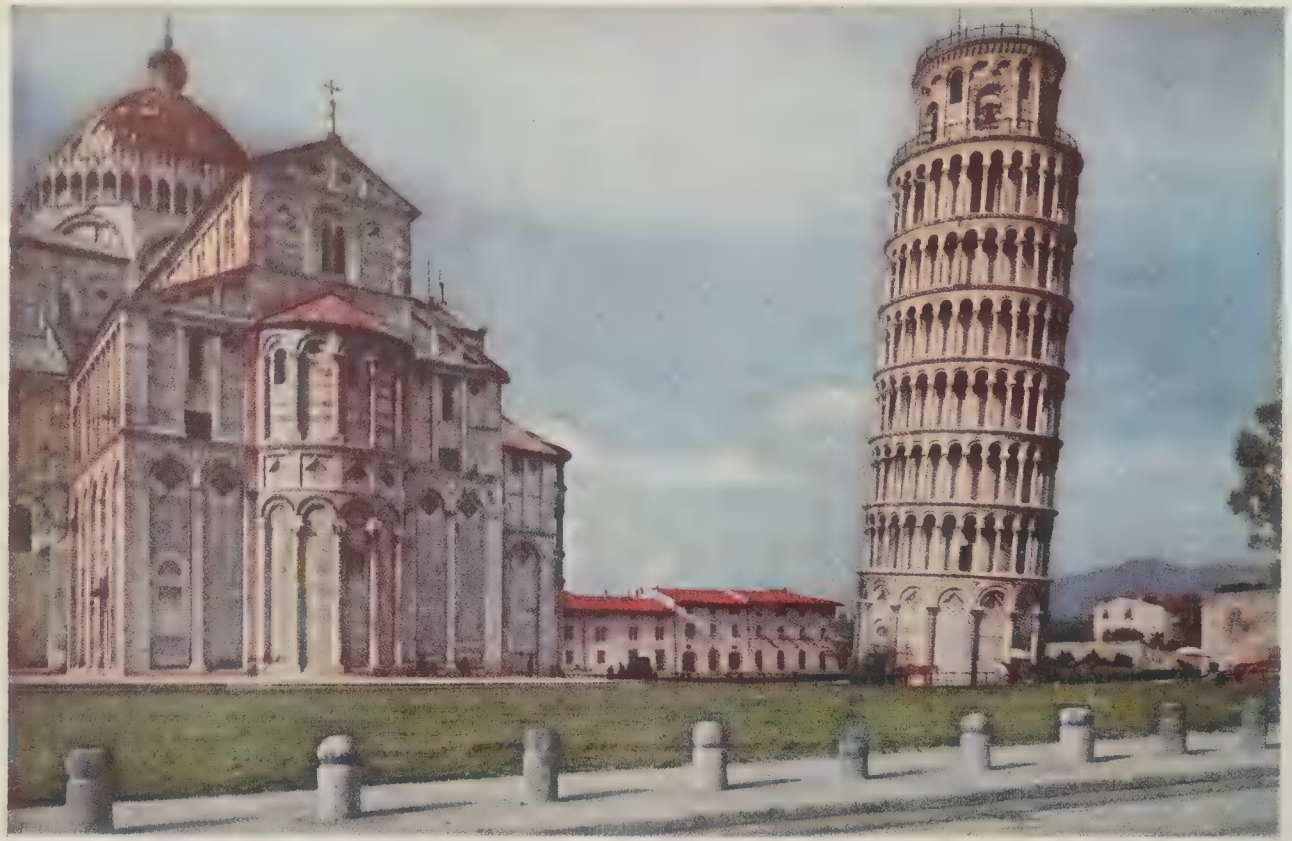
Natural Color Photograph by Hans Hildenbrand

TIVOLI'S WATERFALLS ROAR ON SUNDAYS AND HOLIDAYS ONLY

The cataract of the Aniene is considerably reduced on week days, when its waters are depleted to generate electric power for lighting Rome and driving street cars. Near Tivoli, summer playground for Roman emperors, Hadrian erected his sumptuous villa.



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THE LEANING TOWER WAS ERECTED ASLANT!

Although Pisa's far-famed campanile was intended to be straight, one side began to sag when the masonry walls were only partly finished. The builders altered the plans accordingly, and finished it out of plumb. The inclination increased about one foot during the last century, until now it is about 16½ feet.

© National Geographic Society Natural Color Photograph by Opera Nazionale Dopolavoro

UNDER THIS EMBLEM PISANS OF OLD FOUGHT AND DIED

Trumpeters and pages costumed in the period of the 14th century recall the stirring conquests of this once-powerful commercial and seafaring city. A rival of Florence and Genoa, Pisa sent its fleets foraging throughout the Mediterranean, and took a bold part in the Crusades.

men of Barbary from landing and putting the villages to sack and ruin.

To make things worse, Nature also took a hand in the game. With that great pressure which causes the mountains to rise, the broad sand dune that runs along the sea was buckled and the bottom of the Rio Martino canal was raised a few feet toward the center of its course. The outlet of the waters was thereby closed off.

After the fall of the Western Roman Empire, the Pontine region that once had been well cultivated and livened with villas and cities again became a swampy and desolate waste.

THE STRATEGY OF A MEDICI

Several attempts to redeem the land are recorded; kings and popes tried and failed. But the first with a modern turn of mind to accomplish something effective was Leo X.

That great Pope (1513-1521) declared the draining of the region was a work of public utility and therefore expropriation was a justified procedure. He granted the enterprise to his nephew, Giuliano dei Medici, who made a good business of it.

Giuliano would invite the owners of the land, private persons or communities, to go into partnership with him in the enterprise. The owners, fearing large expenses, would refuse; whereupon Giuliano would expropriate for a song.

The worst case befell the indolent community of Terracina. Following its refusal, Giuliano, at a relatively small expense, dug a short canal to the sea. The accumulated water that for centuries had remained dammed up behind the town ran off gaily and, in a very short time, Giuliano became the lucky owner of vast tracts of wonderfully fertile land on the outskirts of the town. The citizens of Terracina lived for years in lamentation! By this clever work Giuliano grew quite rich.

Two further attempts are worthy of record. One was that of Sixtus V, who, in 1586-1589, had the old water channel, the Flumen Antiquum, enlarged into a broad canal that in his honor was renamed Sisto. Two centuries later Pius VI called the hydraulic engineer, Gaetano Rappini, to avail himself of the modern technique for definitely resolving the problem. The old Appian Way, submerged for a thousand years, was given back to traffic, and along it a great canal was excavated that took the name of Linea Pia.

The Pope, naturally much pleased with his accomplishment, had a tiny obelisk erected near Torre Tre Ponti, on which are engraved the words: "OLIM PONTINA PALUS—NUNC AGER PONTINUS" (Once the Pontine Marshes—Now the Pontine Fields).

Not many years later an earthquake gave a bad twist to the obelisk, and malaria drove away the people who had attempted to settle on the land; also, the Benedictine monks, for whom the Pope had built a nice convent at Torre Tre Ponti, had to leave or died. The traveler could drive along the restored Appian Way, but in winter, on both sides of the road, large sheets of water extended for miles. This was the paradise of sea gulls, ducks, and geese, and of the Roman hunters who stalked the wild fowl while wading behind innocent-looking old horses.

Now an end has been put to all this. When the landowners were called by the Government to unite in a consortium for planning and carrying out the final hydraulic drainage of the region, the Government agreed to contribute to the huge expense the large share of 87½ per cent.

The actual work of road building and canal digging began in 1926 under Senator Prampolini's direction.

THE FIGHT AGAINST MALARIA

In the meanwhile, an effective organization was created, with the assistance of the Rockefeller Foundation, to fight the malaria, because, unless this enemy had been destroyed, it would not have been possible to conquer the land.

The first and most important experimental center was created in the old Caetani castle of Sermoneta. When the work was started, statistics showed that 95 per cent of the population were infected with the disease and that virtually no infant reached its first year without an attack of fever. Yellow little faces and sunken eyes stared at you in the medieval streets. Now new infections are practically unknown and pink and white little cherubs greet you.

After driving away the water and the malaria the next step was to populate and transform the land. The Government issued orders that by the year 1935, for the anniversary of the March on Rome, every acre of arable land, excepting woods, lakes, and certain tracts of lowland awaiting special work, should be colonized.

RADIANT AND CONFIDENT, COLONISTS' CHILDREN PASS IN REVIEW IN THE CITY THAT WAS WRESTED FROM A SWAMP

No trappings of war, but the habiliments of health and happiness, appear as the "Young Italians" parade before the Premier (on stand at left, arm raised in Fascist salute) in the main street of Littoria.

TWO YEARS AGO WILD BOARS ROAMED THE BROOM THICKETS WHERE LITTORIA NOW STANDS

Like a lost Atlantis conjured back from the sea by magic, the bright new city recalls the glory that was Rome (see text, page 201), as it smiles a welcome to peasant families coming to town from the neat farmhouses on the pleasant surrounding fields. Only yesterday malaria mosquitoes swarmed over the stagnating waters of the Pontine Marshes.

RUDDY-CHEEKED CHILDREN ATTEND THE NEW VILLAGES' FINE SCHOOLS

For the success of the Pontine Marsh project, the people must have every comfort and advantage. Prospective settlers ask especially about educational facilities (see text, page 217).

"LITTORIA, SABAUDIA—THIS IS THE WAR WE PREFER"

Veterans and their families work with a will on the reclaimed land (see text, page 201). The harvests are remarkably heavy, for the soil is of incredible richness.

NO MORE WILL WINTER TURN THE LAND INTO A WATERY WASTE

Before canals drained the Pontine Marshes, the wet season was a time of extreme hardship. Now the farmer reaps doubly from the soil enriched through centuries of floods.

CHILDREN, PIGS, AND CHICKENS SHARED THE MISERY OF THE OLD MARSH HUTS

For a graphic illustration of "before and after," compare this scene with the lower picture opposite. When Vergil wrote his "Georgics" the Pontine Marshes were fertile fields.

BEETS LARGE AS BABIES MAKE A DOUBLE ARMFUL FOR YOLANDA

Happy and healthy, this sturdy child of Todi feels just pride in the products of the farm she and her family till. She is one of the colonists who have settled on the author's land.

The Government has offered financial assistance to the landowners in building, on every 30 acres of land, a house with stables, pig and chicken pens, and a baking oven. Money is loaned at 2½ per cent interest. If the owner refuses, his land is expropriated and the war veterans' organization undertakes the work (see page 201).

Personally, I have obeyed, and I must say that, though the work has been hard and the financial strain great, I feel satisfied in seeing on my 2,500 acres of land so many happy and prosperous families that a year ago were living in poverty.

These families are called from the overpopulated central and northern provinces of Italy, where the institution of the *mezzadria* is more than a thousand years old.

The mezzadria is a partnership contract, of a patriarchal nature, between the landowner and the head of the peasant family. The landowner gives the land, pays the taxes, supplies the machinery, and anticipates the capital expense for the cattle. The peasant, with the whole of his family, supplies all the labor, the cart, the plow, and the small working tools.

In Italy these people are called *famiglie coloniche* to distinguish them from the *contadino,* who is a day laborer or works his own little piece of land. Whereas the farmer *(affittuario)* pays rent, the *colono* is not paid and does not pay anything, living almost exclusively from the products of the soil.

Very often the coloni, who are handy at all trades, make their own shoes, and from the wool of their sheep make their own clothes. They build their carts, weave baskets, and every housewife bakes her own bread from the wheat grown on the land. They are self-sufficient; they may be poor, but are never in misery.

According to the mezzadria contract, everything that goes in and everything that comes out is on a fifty-fifty basis. The sacks of wheat gathered from the harvest are divided in two; the fat pig, when sacrificed at New Year, is split neatly in half, and one round cake of fresh cheese

goes to the peasant for every one that goes to the landowner; the proceeds from the sale of a calf are divided, and likewise the losses when a cow dies.

The owner guides the peasant family economically; he should also do so morally. Officially, he deals with only one responsible member of the family, the father, or, if the father is too old, with the eldest son. Accounts are noted day by day in special registers called colonial booklets, of which one copy is in the hands of the head of the family and one copy is held by the landowner. The latter, in a way, is the banker of his peasants, trying to save the money from being squandered in years of prosperity and financing the family through hard times. Men are not always perfect, but the system generally works very well.

EVERY HOUSEHOLD MEMBER HAS HIS TASK

Everybody works; even little children eight years old, when free from school, watch the sheep graze along the ditches. The babies and the farmyard industry—pigs, chickens, geese—are the exclusive domain of the womenfolk. The land gives back tenfold what is put into it.

At harvest time everybody helps. The women are in the turmoil of straw, dust, and milling machinery, and, with a red bandanna handkerchief tied around their perspiring brows, they handle the sheaves. And they sing—sing with the full joy of life. The Duce shares in this festivity, for the harvest is the great festival of agricultural life. Last year for two hours he took a hand in the game, feeding the sheaves into the threshing machine, after which he smilingly cashed his pay of 4.50 lire (about 38 cents) for the work he had done.

When the wheat has been sacked and the sacks have been divided, the housewife spreads a white cloth on a table under a shady tree and serves the traditional roast lamb, home-made bread, and *fiaschi,* the sweet local wine. Everybody who has taken part in the work, neighbor helping neighbor, landowner included, partakes of the feast.

Such is the association between peasant and landowner on the mezzadria contract. The contract has the duration of only one year, but it is always renewed unless something very serious has happened. Peasant families remain on the same tract for generations; some claim to have lived there for hundreds of years.

The ground is cultivated in a five-year rotation. Wheat, barley, alfalfa, beets, etc., are planted in succession, so that every year each part of the land has a different crop. At the end of the fifth year the cycle begins again. The stables are the index of the farmer's qualities, and the curing of the manure is brought up to a fine art.

Usually these peasants are excellent people, docile and hard-working, the backbone of the country. They care more for their fields and their cows than for politics; they go to bed early, get up at sunrise, are sober, and procreate an amazing number of healthy children. These have plenty of fresh air and simple but wholesome food, which gives white teeth.

The State takes care of their education. Each child that grows up is an additional worker for the family. When the hive gets full, the swarming takes place, and that is the reason so many families are willing to come from Venice or Siena or Perugia to settle on the Pontine land.

The mezzadria is something of a life in common. It is well to find out who are the persons that are going to live on your land. For this reason I always go to pick out in their homes the peasants I need.

Upon my arrival the whole family is mustered: the men are called back from the fields, where the oxen remain waiting with the yoke on their necks; the smaller children are gathered from under the tablecloth.

"How much land do you give us?" they ask. "Does the wheat grow well there and is there a vineyard already? How far is the church, and where are the schools? Is there nothing to fear any more from malaria?"

These are the questions. But the peasants generally know pretty well already, because they have a wireless communication among themselves. Friends write to friends, and those who go back to the old home on a visit speak in glowing terms of the promised land.

MAIN ENTRANCE TO THE PARK OF OLDEST LIVING TREES

Towering veterans, nearly 2,000 years old when Christ was born, stand hale and hearty in this tree sanctuary in California. Here, beside blue lupines, a uniformed park ranger points out to visitors snow-veiled Alta Peak.

Photographs by Clifton Adams

FROM WARM CITIES OF LOWLAND CALIFORNIA, WINTER VISITORS MAY REACH PARK SNOWS IN A FEW HOURS

Sport lovers eagerly await news of the season's first deep snowfall. Then, with skis, staffs, and toboggans tied on their motorcars, they dash for the park, where rangers have prepared the slides and lodges are warmed and ready with hot food for the hungry horde.

AMONG THE BIG TREES OF CALIFORNIA

By John R. White

Superintendent of Sequoia National Park

THINK of an ant crawling on the ground through a vast cornfield, looking up at the tall stalks.

To the ant the cornstalks are as high as these California Big Trees are to a man gazing up at their distant tops.

But it is their astounding age, as well as their size and beauty, which fills the soul of puny man with awe and reverence for the Creator.

Big Trees, stout and healthy to-day, were centuries old when Christ was born. Men call them "the oldest living things." So nearly indestructible are they that some naked, fire-scorched trunks still stand, though dead before America was discovered; others, which fell centuries ago, remain sound and solid inside. Such vitality has the sequoia that when felled its branches do not wither for years. One giant crashed in 1926 when I was near. I saw it again, in 1931; its foliage was still fresh and green.

They link us with the past. Their sequoia forbears grew here when the world was younger, when reptiles likewise grew to enormous size. Such mammoths as the dinosaur, unable to adjust themselves to climatic and other changes, faded from the earth; but the sequoia family endured and saw the rise of the mammals. Yet to-day, when you walk beneath these towering tree giants, you feel that the deer and the squirrel hardly fit into a scene set for the brontosaurus and the pterodactyl.

SEQUOIAS GREW MILLIONS OF YEARS AGO

Time was when the *Sequoia* genus was spread over four continents. At least twelve fossil species are known, scattered from Greenland and across Europe to Asia. Fossilized trunks as much as 10 feet in diameter and nearly 30 feet high still stand in Miocene deposits in Yellowstone National Park. The wood of these petrified trunks under the microscope looks very much like that of the trees alive to-day.

These ancestors of our present sequoias formed much of forests which in ancient days clothed polar regions now barren or locked in ice. Only two species survived the Glacial Epoch, and these are now practically limited to California.

Some people confuse California's Redwoods with its so-called "Big Trees." Both are "big" and both are of the genus *Sequoia;* both have pink or red wood and both are trees of the largest size. But they are two species, distinct in habitat, in bark, foliage, and in reproduction.

The Coast Redwood, or *Sequoia sempervirens,* is found only near the coast or within the belt of sea fogs, and extends from southern Oregon down to Monterey County, in California.

The larger species, the California Big Tree, or *Sequoia gigantea,* is confined to the western slopes of the Sierra Nevada, between 4,000 and 8,500 feet elevation, from Placer County, in the north, to Tulare County, in the south, and is much more abundant in the south than in the north.

The Coast Redwood forms an almost continuous forest in which it is the dominant stand; the Big Trees grow in scattered groves, 71 in all, interspersed among the heavier stands of white fir, sugar pine, and other trees.

Though smaller in diameter and bulk, the Coast Redwood is taller than its cousin, the Big Tree. The former attains a maximum height of 363 feet and a maximum base diameter of about 25 feet; the latter has a maximum height of about 300 feet and a base diameter of about 35 feet.

When the Coast Redwood is cut down, it "stump-sprouts," as foresters say. A ring of young trees springs up around the stump of the slaughtered *sempervirens;* hence its Latin name, the "Ever-living Sequoia."

But the Big Tree reproduces only from seed; and, since its seeds require specially favorable conditions to root, there was real danger of the extinction of the species until national and State parks were created.

The bark of the Coast Redwood is brown and gray; that of a mature Big Tree has warm hues, from maroon to several shades of red, which at sunset often shine with strange brilliancy. Big Tree forests are open, sunny, and full of color. The Coast Redwood forests are by contrast damp and somber.

The foliage of the Coast Redwood somewhat resembles that of the fir or hemlock, but the slender, prickly foliage of the Big

Photograph by Lindley Eddy

HERE WILD ANIMALS WALK IN PEACE WITH MAN—USUALLY!

Now and then, however, as when famished after hibernation, a bear turns outlaw, breaking into vacant cabins or even smashing parked automobile windows in quest of food. Then he is trapped in a "bear patrol," a wire cage mounted on a truck, squirted with red paint to "mark" him, and deported to a remote region of the park.

Tree has no counterpart in America. The only tree which at first glance might be confused with the Big Tree is the cryptomeria of Japan.

ICE AND FIRE WERE FIRST FOES OF THE BIG TREES

Ages before man came to chop these trees for his use, ice and fire were their fierce foes. Again and again moving glaciers mowed them down—glaciers whose icy fingers stretched down mountain canyons to freeze all animal and plant life. Whether in warm and sheltered spots a few trees remained, or whether only seeds survived, can probably never be known; but slowly the cold hands relaxed and the forests returned. The fact that the Big Trees are more abundant and larger in the southern part of their range indicates that there the effects of the glaciers were less severe.

With the passing of the Age of Ice, the struggles of the sequoias had only begun. Fires followed the ordeal of ice. The abundant rains ceased, and long, dry summers rendered the forests tinderlike, ready to be ignited by lightning or by brands tossed by Indians to drive out game or clear land for forage.

There is scarcely a mature sequoia that does not show the effects of at least one fire. Every 20 or 30 years flames swept through

Photograph courtesy National Park Service

INTO FORESTS PRIMEVAL TRAIL THE GUESTS OF UNCLE SAM

But let them not confuse Big Trees with the Redwoods. Although both are members of the famous *Sequoia* genus, the two groups of forest monarchs reside in separate parts of California. These Big Trees, the larger of the two, are found on the western slopes of the Sierra Nevada, while Redwoods, which are taller, thrive along the rugged coastline from Monterey County northward to Oregon (see text, page 219).

the forest, sometimes licking hungrily, but with little effect, at the thick, asbestoslike bark; again, where a litter of boughs and fallen logs was piled up against a Big Tree, the fire burned fiercely enough to penetrate the outer cover and into the heart. That is why the great black caverns in the living sequoias are almost always found on the upper side of those standing on a slope.

THE SEQUOIAS HEAL THEIR OWN WOUNDS

Careful inspection of a Big Tree, even one with an unbroken front of new bark, usually shows traces of many fires. Often an arrow-shaped scar runs from the base a hundred feet or more toward the crown. Such blemishes, covered by new bark, were caused by fires long before the discovery of America. For centuries the tree grew new bark, at the rate of half an inch or less a year, until finally the wound was healed.

Tree torches burning in the Sierra Nevada might have signalized every event in recorded human history, from the building of the Pyramids to our own Civil War.

The length of time that the black, charred wood, soft as it is, has adhered is equally astonishing. With your thumb nail you can chip off pieces of charcoal formed by fires that burned hundreds of years ago.

Photograph by C. O. Schneider

THE GIANT TREES ARE NAMED FOR SE-QUO-YAH, A CHEROKEE INDIAN SCHOLAR

Soon after the adoption of a phonetic alphabet of 86 symbols, invented by Se-quo-yah (who knew no English), many members of his tribe learned to read and write. With type made of such symbols, the Gospels were printed; also tribal laws and even a newspaper. This group of closely massed giants is

Photograph by Hammond

THIS CAVELIKE SEQUOIA MIGHT SERVE AS A GARAGE FOR TRACTORS

Perhaps an Indian camp, or their fires set in hunting, or lightning, long before Columbus touched American shores, kindled the blaze which first scarred this tree. Succeeding fires enlarged the wound, ate out the heartwood, and left this tough bark cavern of enormous magnitude (see text, page 220).

Photograph by C. O. Schneider

THESE PEOPLE ARE DWARFED TO PYGMY SIZE BESIDE HUGE "GENERAL SHERMAN"

Containing lumber enough to build a good-sized village, it measures 36½ feet in diameter. From the ring count of a core, drilled through the heart of this tree in 1931, Dr. A. E. Douglass estimated its age to be between 3,500 and 4,000 years (see text, page 231).

No doubt the Coast Redwoods were seen by the first Europeans to visit our Pacific coast. Yet for more than two centuries after the visit of Sir Francis Drake, in 1579, white men roamed up and down California apparently without climbing far enough up the high Sierras to find the Big Trees.

The Indians knew them, of course. In summer they camped among them and left potholes in granite rocks where they ground acorn meal.

Even now the identity of the first white men to gaze on the Big Trees of the Sierras is in doubt. It may have been some member of the Joseph R. Walker Expedition of 1833. One Zenas Leonard, clerk of the Walker party, recorded:

"In the last two days' traveling we have found some trees of the Redwood species incredibly large, some of which would measure from 16 to 18 fathoms (96 to 108 feet) around the trunk at the height of a large man's head from the ground."

That group of Big Trees, now known as the Calaveras North Grove, was, however, the first of these sequoias to become well known.

In the spring of 1852 A. T. Dowd, a miner of Murphy's Camp, in the historic Mother Lode district, followed a wounded bear into the sequoias. He came running

back to his companions and excitedly dragged them with him to see "the largest bear in California." What he showed them was a Big Tree—probably the one which afterward was felled and a dance hall built on top of it.

John Bidwell, a member of the first immigrant party to enter California by the overland route, stated that he saw the Calaveras Big Trees in 1841; but Dowd is popularly given credit as the discoverer of the *Sequoia gigantea*. It was the Calaveras Grove which inspired Bret Harte to write his poem, "On a Cone of the Big Trees."

Photograph by Lindley Eddy

THE PLAQUE RECORDS THE GIFT BY YOUR SOCIETY OF THESE BIG TREES TO THE NATION

The text reads: "The tract of land on which this tablet has been erected, together with four other tracts of land, all within the heart of the Giant Forest, was purchased from private owners with funds subscribed by the National Geographic Society, together with an appropriation by the Congress of the United States. These areas were deeded to the United States on December 30, 1916, for the benefit of and to serve the people of the Nation." Col. John R. White, Superintendent of Sequoia National Park, and a visitor inspect the marker (see text, page 231).

DISCOVERY OF THE GIANT FOREST

In 1857 Galen Clark discovered the Mariposa, or Wawona, Grove in what is now the Yosemite National Park. The following year Hale D. Tharp, a pioneer of Three Rivers, in Tulare County, was led up the Middle Fork of the Kaweah River by Yokut Indians, and on up the grassy slopes beneath Moro Rock to the plateau where grows the noblest forest of the *Sequoia gigantea*, the Giant Forest, in what is now Sequoia National Park.

THE "GENERAL SHERMAN" MAY BE THE WORLD'S LARGEST TREE

Few explorers have left as permanent a record of their discoveries as that made by old Hale Tharp. On a fallen, hollow sequoia log the bold and well-formed characters, "H. D. Tharp, 1858," stand to-day almost as fresh as when he carved them. A glassed frame now protects them from vandalism.

Here, in Sequoia National Park, stands that hoary veteran of all Big Trees, the "General Sherman," found and named by James Wolverton in 1879.* Many other trees, including Redwoods, Douglas firs, and the Australian eucalyptus, are taller;

* See "The Oldest Living Thing," Pictorial Supplement, NATIONAL GEOGRAPHIC MAGAZINE for April, 1916.

Photograph courtesy National Park Service

LODGES, STORES, A POST OFFICE, AND RESTAURANT STAND AT THE ENTRANCE TO THE GIANT FOREST

Every effort is made to insure the comfort and enjoyment of the visitor. Tent accommodations are available [illegible]

Photograph by Padilla Studios

"LET'S WATCH THEM FEED THE BEARS"

Gorged on rich camp "left overs," these bears get so fat and lazy they no longer forage for themselves. The appalling gluttony of the animals, and their grotesque, flat-on-the-back and feet-up attitudes as they later sprawl about and "sleep it off," amuse the crowd, especially the youngsters.

Photograph from Gilbert Grosvenor

PRESIDENT THEODORE ROOSEVELT ON HIS HISTORIC VISIT TO THE REDWOOD GROVE AT SANTA CRUZ IN MAY, 1903

In a speech here, among the Coast Redwoods (see page 219), Colonel Roosevelt urged the protection of the giant trees, "whose architect has been the ages. . . . The rash creature who wishes to leave his name to mar the beauties of Nature should be sternly discouraged. Keep these trees . . . unmarred by the vandalism . . . of man." The bearded man on the left of President Roosevelt (center) is the late naturalist and explorer, John Muir, and next to him stands Dr. Nicholas Murray Butler, President of Columbia University.

Photograph by Capt. Albert W. Stevens

FROM ON HIGH, GIANT SEQUOIAS APPEAR AS GREEN TOY TREES SET ON A CHRISTMAS TABLE

Roofs of Park Headquarters' huts, protruding from a 20-foot fall of snow, spoil the illusion and give a true scale. After such deep snows, winter visitors flock in with sleds, skis, and snowshoes (see page 218). Last winter Otto Steiner, famous German alpinist, climbed Mount Whitney and skied down—the first to achieve this feat.

Photograph courtesy National Park Service

BENEATH A BIG TREE, A MAN IS AS PUNY AS AN ANT ON A CORNSTALK!

Up and up—right out of the picture stretches this gnarled member of the royal family of treedom in Giant Forest. Actually it is two trees—twin Big Trees united several feet above ground. To the man standing at the left they appear as a huge natural archway. Housed in the rustic museum beyond are specimens of plant and animal life found in the park and examples of handiwork by the Yokut Indians.

but no other, so far as I know, has its bulk. Its greatest base diameter is 36.5 feet and its trunk contains 600,120 board feet of lumber.

You can imagine its size when told that a train of 30 railway cars would be required to haul its trunk alone. One limb, 130 feet above the ground, is nearly seven feet thick. Sawed into boards, the tree would build about forty 5-room houses!

In New Zealand, kauri pines attain a diameter of 20 feet, and in Tule, Oaxaca, Mexico, a giant cypress, said to be 6,500 years old, measures 58 feet in diameter and 255 feet in height. The reputed age of the latter is, of course, a guess, and the diameter may include a number of stump sprouts around a dead tree, which have coalesced into a solid bole.

So far as is reliably known, the California Big Trees are the oldest and largest living things in the world; but there is an opportunity for some explorer and lover of trees to investigate the arboreal monarchs of the world, to see whether there are any legitimate disputants of "General Sherman's" title to the "oldest and largest living thing."

When a tree is older than the Christian era, there is no need for exaggeration. Yet there has been much confusion about the ages of the Big Trees and the Coast Redwoods. Guesses of 5,000 years and more have been made.

The only way to determine the age of a tree is by counting the rings of annual growth. To get this count, one must either saw down a tree or take core borings.

The oldest Big Tree found by Huntington was 3,150 years old, and he found only three over 3,000 years and 79 over 2,000 years. John Muir states that he counted the rings of one tree in the Converse Basin that showed an age of more than 4,000 years; but diligent search has failed to rediscover that tree.

Dr. A. E. Douglass, of the University of Arizona, a leading authority on the relation between weather cycles and tree rings,* took a boring of "General Sherman" in August, 1931. Results of his experiment indicate that the tree is between 3,500 and 4,000 years old.

* See "Secret of the Southwest Solved by Talkative Tree Rings," by Andrew Ellicott Douglass, in the National Geographic Magazine for December, 1929.

Until white men came with ax, saw, and dynamite, the Big Trees' only enemies were ice and fire. Yet in a few short years of logging perhaps as many Big Trees as now remain in the Giant Forest were destroyed.

In one area alone, the Converse Basin, mammoth sequoias by the score were felled and scarcely used. With the passing of their shade, moist, flowery meadows were also turned into dreary sand flats. Here stands what is called the "Chicago Stump," all that is left of a Big Tree felled in 1891, sections of which were shipped to Chicago for exhibition at the World's Fair.

That tree was reported to have been 300 feet high and 26 feet in diameter where cut. A later estimate shows it may have been larger, even larger than the Sherman tree. Two men, using an extra-long saw made by brazing two 12-foot saws together, worked thirteen days to cut down the Chicago tree!

SAVING THESE GLORIOUS TREES FOR MAN'S FUTURE ENJOYMENT

To save some of these trees, the Sequoia National Park was created in 1890, and for years patrolled each summer by United States cavalry.

Private individuals, however, still owned the finest parts of the sequoia forests and had, of course, a perfect right to cut them down for lumber. To avoid this, the late Stephen T. Mather, as Director of the National Park Service, asked Congress for funds with which to buy and save more of the Big Trees. An appropriation was made, but it was insufficient.

Then aid was asked of the National Geographic Society. Immediately, from its own funds and with voluntary contributions from individual members, it subscribed sufficient to purchase the lands and Big Trees desired (see illustration, page 225).

In all, The Society bought and gave to the United States a total of 1,916 acres at a cost of $96,330.*

In early days of the park, when cavalry rode its trails, visitors were few—not more than 3,000 to 4,000 people a year. Now, with motor roads, hotels, and comfortable Government-owned camp grounds, this season may bring 150,000 visitors.

Stand at the park entrance long enough

* See, in the National Geographic Magazine, "Our Big Trees Saved," January, 1917, and "The National Geographic Society Completes Its Gifts of Big Trees," July, 1921.

Photograph by Padilla Studios

THEY LIKE CANDY, CAKE, AND BREAD, BUT APPLES ARE PREFERRED

Thousands of mule deer roam the reservation. Ordinarily among the wildest of animals, they become tame and inquisitive under park protection. Hospital Rock (right background) is the place where Yokut Indian medicine men once chanted incantations over sick tribesmen.

and you may see motorcars from every State in the Union and Canada. Thousands flee the desert and lowlands heat for the cool, pine-scented forest shadows 7,000 feet and more above sea level.

Some are most amused by park bears fussing over the camp garbage (see page 227). Some fish or hike, or want to climb near-by Mount Whitney, 14,496 feet high.

"How high is *this* tree?" some ask; or, "How old is that one?"

Others, in the midst of the Giant Forest itself, will ask, "When do we get to the Big Trees?"

Some read, some sleep, ignoring it all. Some walk off alone, to sit silently a long time, gazing up at the giants.

Although summer visitors are most numerous, increasing numbers now come in winter for the snow sports. California newspapers are quick to report the first falls of snow heavy enough for coasting, and any week-end after snow has fallen girls and boys in bright-colored Alpine costumes, with sleds, skis, and toboggans lashed on their motorcars, come swarming up to the park from Los Angeles and other near-by cities. Park officials and lodge-keepers take especial pains for the comfort and safety of these "snow birds" (see page 218).

Winter or summer, all visitors are the guests of Uncle Sam; for them, for posterity, he saved the Big Trees.

WHEN THE HERRING FLEET COMES TO GREAT YARMOUTH

By W. Robert Moore

Author of "'Land of the Free' in Asia," "The Glory That Was Imperial Peking," "Motor Trails in Japan," etc., in the National Geographic Magazine

With Illustrations from Photographs by the Author

TO DAVID COPPERFIELD, riding into Great Yarmouth with Peggotty on a carrier's cart, "the town and tide seemed too much mixed up, like toast and water." But Peggotty, stirred with civic loyalty, declared with emphasis that, "for her part, she was proud to call herself a Yarmouth bloater."

For many centuries before the strokes of Dickens' pen sent young David through the narrow streets where he "smelt the fish, and pitch, and oakum, and tar, and saw the sailors walking about, and the carts jingling over the stones," Yarmouth was inseparable from the sea—and the herring harvest. To the sand bank that blocked the estuary at the mouths of the rivers Yare, Bure, and Waveney, fishermen long have resorted to land their fish and dry their nets, and on this sand bank Yarmouth has grown, along with the expansion of the herring industry.

A CIVIC SYMBOL, LIKE BOSTON'S COD

Appropriately enough, her ancient civic arms bore three silver herrings against an azure field that might have been a bit of the sunlit North Sea itself. In the war with France during the reign of Edward III, however, because of the able assistance of Yarmouth's fleet, born of her fishing craft, these were dimidiated and had their heads replaced by those of the royal lion (239). By her ancient charter, too, the city sent annually to the English monarch's kitchen "100 herrings baked in 24 pies or pasties."

To-day, as when the shimmer of herrings determined the prosperity and sea power of the Hanseatic merchants, the Dutch, and the English, Yarmouth still looks to the sea. True, the town has seen many changes in recent years, and publicity pamphlets are inclined to emphasize the benefits of the stimulating sea air along the wide promenades and the recreations provided at the piers and boating pools.

However, when *the season* has ended along the beach and the summer pavilions have assumed the appearance of mausoleums, a new *season* begins along the river banks and on the Denes.

Here, from October to December, herring is king. Hundreds of steam drifters clutter the harbor of the world's premier herring port. Tackles rattle; trucks and carts clatter over the stones of the quay and about the curing yards with bulky loads of fish baskets and coal; auctioneers cry for bids from local and foreign buyers; and, as a background to shrieking whistles and sundry other noises, there is the constant ring of laughter and the chatter of the rhythmic Gaelic tongue. Incoming trains debouch into Yarmouth some 3,500 Scottish fisher girls and many hundreds of longshoremen to handle and cure the herring catches.

Here resort also the butchers and bakers and sweetmeat makers, for Scottish palates must be catered to. Churches announce special services, entertainment societies flourish, and shopkeepers display goods to appeal to the fisher folk. Countless window signs urge visitors to "Send a box of famous Yarmouth bloaters to your friends," while candy makers, not to be outdone, advertise "Yarmouth rock, the candy with the fish center." In its favor, however, it should be said the fish center of the candy refers to a colored fish design in the stick rather than to the flavor.

The bustling pageant centers on Yarmouth's water front. Lowestoft, also, a few miles distant down the coast, presents a similar scene of lesser magnitude.

ABOARD THE "VIOLET AND ROSE"

It was one of those dull, gray, fog-laden English mornings in late October when I stepped aboard the *Violet and Rose,* captained by Ronald Balls, as the hundred-odd English drifters began to unloose their moorings and put out to sea from Yarmouth.

It was also Sunday; consequently all the fleet was in, as fishery laws require that every ship return to port on Saturday. The 540 Scottish drifters that lay tied up five deep on either side of harbor, however, would remain idle until the following morning, in accord with the ancient Scottish

AT DAWN THE HERRING FLEET STEAMS OUT TO SEA

With their smoke pluming into the dull, fog-laden sky and gulls screaming overhead, steam drifters file out of Great Yarmouth's harbor and breast the seas to the fishing grounds. All boats return to port each Saturday (see text, page 233).

regulations. "Man works six days and rests one," it has been said; "so, too, let the herring rest one and they will come to the surface better on the others."

Like bats in a belfry tower, the boats milled about in the mile-long river harbor and then strung out in single file to breast the sea that came surging against the entrance piers.

"Are you a good sailor?" questioned one of our crew, as I braced myself against the rail to get a photograph of the ship ahead of us, while she reared and careened on the pitching sea. "It will probably get you, because this isn't exactly an ocean liner," he added, when I indicated that I was enjoying myself at the moment, anyway.

THE RICHEST HERRING FISHING GROUND

For two days fairly high seas had been running, and one of the drifters returning home had crashed into the pier. She lay beached near by and was breaking up under the impact of the heavy surf. Because of its shallowness, the North Sea rises quickly, often causing considerable havoc among the fishing craft.

Navigating an unsteady course over the tilting deck, as the little 90-ton *Violet and Rose* stood first on her nose and then settled back on her haunches, I joined the skipper in the wheelhouse to look at the charts of this richest of all herring fishing grounds.

"Here's where we get our herring runs at this time of the year," he explained, tracing his finger down around Smith's Knoll and several other shallows in its locality, some 25 miles off the coast.

To me it seemed almost incredible that the fishermen should rely so definitely on the belief that the vast herring shoals would be at such a specific location at a certain time. But for centuries the fish have appeared with such unfailing regularity at their annual feeding and spawning grounds that never has a fishing season been without success.

In some seasons, it is true, their appearance has been delayed for a short time by local conditions of the water and unusual currents. Early in the 1933 season unusual conditions did exist to delay the migration. Two large areas of floating organisms *(Phaeocystis* and *Biddulphia sinensis),* often referred to by fishermen as "weedy

HERRING IS KING AT GREAT YARMOUTH

From ship to pier, under the auctioneer's hammer, and into the curing yards, the fish are cared for with surprising dispatch. Yards are cleaned frequently and the water front sluiced daily, so there is little odor of stale fish. Oddly shaped double baskets, called "swills," are used for carting.

water," or "Dutchman's baccy juice" (because of its brownish color), lay directly across their normal path. Its recognized distastefulness to the fish had halted their progress, but by going around or making a hurried dash through the obstacle, the vast shoals eventually returned unerringly to their old haunts.

WHEN HERRING MADE HISTORY

Elsewhere, herring shoals have unexpectedly shifted their migratory courses, and by so doing have shifted the powers of nations. Such was the case when finny hosts failed to return to the Baltic.

The mighty commerce of the Hanseatic League had as one of its substantial foundation stones the Baltic herring trade. In providing fish for its markets, the League had extended its power far and wide to traffic in other goods as well. The Hansa merchants did not go to sea themselves; the Danes did their fishing for them. But when the herring quit the Baltic grounds, economic depression hit the League. The three golden herrings that were emblazoned on Lübeck's coat of arms lost much of their former luster.

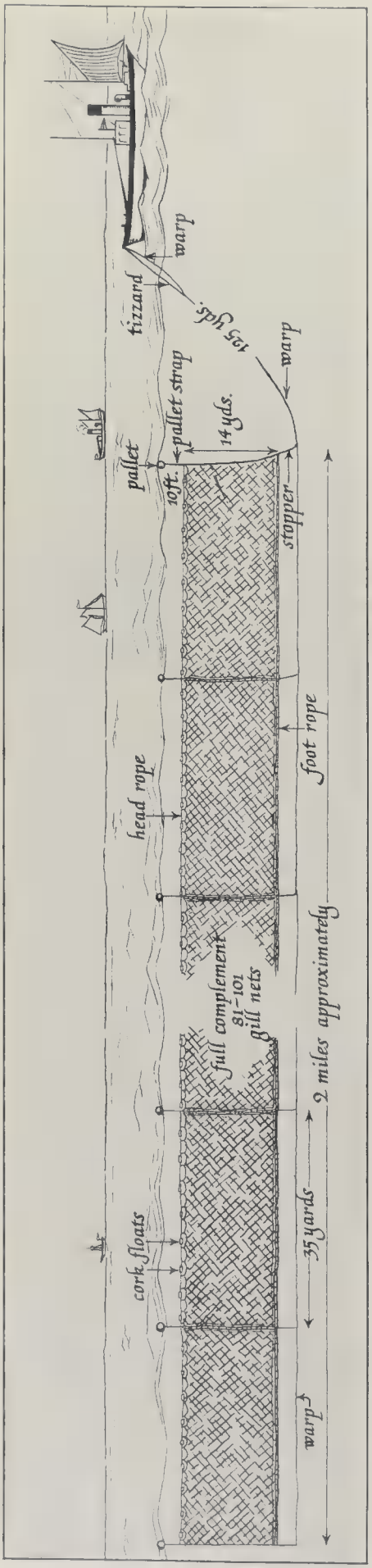
Of course, the whole story of the decline of the Hanseatic League is not as simple as the above statement, because its commerce had many ramifications.

Cruising over these North Sea waters, one ponders on the rivalry that long existed between the Dutch and the English over questions that had their origin in the countless billions of herring that have moved back and forth through these territories.

And how like some of the conversations that must have taken place in centuries gone were the words of the skipper!

"Yes, this boat did patrol work during the war; all of them did, for that matter. There aren't any new ones. The loss of our Russian and other markets during the war has made our fishing a poorly paid industry. Practically all of the steam drifters are mortgaged to the limit, and there seems little prospect of paying them off. Now the Germans and the Scandinavians, on government subsidies, are building new boats, with Diesel engines, that will cut further into our markets, because they are much cheaper to operate."

The talk of slump in markets, falling prices, and gluts of fish was interrupted by



Drawn by Elsie Dunn Burrhus

A DRIFTER RIDES THE NORTH SEA WAVES MOORED TO HER TRAIN OF NETS

Strung out in a long line across the tide and buoyed vertically by inflated pallets, these nets ensnare vast shoals of herring as they move across the fishing grounds.

the cook's call to lunch. Together we went astern, lurched into the tiny galley where the broth from the joint was spilling onto the hot stove at every roll of the ship. We crossed in front of the doorway of the engine room, from which issued pungent oily fumes, and then backed down the hatchway ladder to the cabin.

"Still going strong?" asked the member who had referred to seasickness.

"Still going." And I attacked a piece of joint, potatoes, and peas, while holding the plate in my hand.

Instead of sea chanties, the crew were humming the popular jazz tunes that came blaring from the loudspeaker of a radio.

Here, in this small, ill-ventilated cabin and in the bunks, arranged like cupboards along its sides, the ship's crew of ten spend their hours when they are not on deck bending, casting, or drawing their nets. If the catches are heavy, there are precious few hours below deck, even for eating, because of the grueling hours of hauling, quick return to port for unloading, and preparing nets for the next catch.

AN ECHO FROM SHOALS OF FISH

By late afternoon we reached a place where the skipper thought the water "looked pretty good." More progressive than the other captains, however, he was also trying to approach the fishing industry from a scientific angle and had equipped his boat with a depth-sounding device. On this we had seen a number of flashes beside the one which indicated the ocean depth, a suggestion that we were perhaps getting a secondary echo from the backs of a shoal of fish. So densely packed are some of these massive shoals that it is quite possible to detect their presence.

"Up with the flag and get ready to shoot," called the skipper. A flag, indicating to other vessels that we were drifting, was raised at the bow, and, with the engines running dead slow, the two miles of nets were "shot" across the tide. Then, mizzen-sail raised to hold the boat into the wind, engines were stopped and we drifted, wallowing in the restless sea. Night lights on the other drifters gave one the impression of being in the center of some vast circular town.

"All shot, well laid, may the Lord send them back well paid," is the herring fisherman's saying and his hope.

The gill nets are about 35 yards long by half that width and are buoyed up to within 10 feet of the surface by inflated

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UP AND OVER, BUT IT'S ALL IN THE DAY'S WORK

On the tossing decks are piled inflated canvas pallets, or buoys, which keep afloat the two-mile string of gill nets. Drifters have earned their name by the method of fishing which they employ—idly drifting with the tide and wind until their nets are drawn. A trawler, on the other hand, *drags* a long line of baited hooks or nets.

A SMALL "SHIMMER" OF HERRING ROLLS OVER THE GUNWALES

When the haul is heavy the nets suggest thick silvery blankets, so closely are the fish enmeshed. Last year the herring runs were so large that much expensive gear was torn away because of the colossal burden (see text, page 240). Two inflated canvas pallets, which buoy the nets, bob in the foreground.

THE "VIOLET AND ROSE" SHOOTS HER NETS

Each steam drifter usually casts about 100 nets, although superstition dictates that it must not be an even number. A pallet is being hurled overboard in this photograph (see diagram, page 236). A Dutch sailing drifter lolls on the horizon.

canvas pallets. Although usually about 100 nets are employed by each drifter, superstition dictates the use of an uneven number.

Many other superstitions prevail among the herring-fishing hands. For some reason salmon are never mentioned by name. If one must talk of them, one calls them "cold iron." Whistle and you are certain to bring a gale. To start on a venture on Friday is to court ill luck.

To meet an old lady with a cast in her eye just before going to sea is a sure sign that poor luck will attend the fishing. This can sometimes be overcome by making an effigy of her and burning her as a witch. Years ago persons in fishing villages were often singled out and accused of working witchcraft on the herring runs and were burned in effigy. Others, less fortunate, were ingloriously ridden out of town in wheelbarrows.

Deeply religious as many of the Scottish fishermen are, they never like to see a minister come anywhere near their boats. Herring bones have to be disposed of by other means than burning, as an ancient saying runs: "Catch me, kill me, but don't burn my bones."

GREAT YARMOUTH HONORS THE HERRING ON HER COAT OF ARMS

After her fleet aided King Edward III in the wars with France, the armorial fish on an azure field were decapitated and the heads replaced by royal lions. This plaque and statue adorn the walls of the 16th-century Tolhouse, now converted into a museum.

DRAWING IN THE NETS

Herring often swim at the "close," shortly after dark, or else move at the change of tide. At 8:30 that evening all hands were called to draw in the first two nets to see what the catch had been. As they came up comparatively empty, they were dropped back again.

At 3:30 o'clock in the morning orders to haul away were again given. Nets came rolling in over the gunwales; herring flashed in silvery iridescence under the glare of acetylene lamps. "Spin up, spin up" (probably a corruption of "swim up"), repeated the skipper in the traditional formula of the sea.

For four hours the men hauled, taking turn about at different positions to relieve the monotonous strain. Herring flew in every direction as they were shaken from the nets; decks were covered with their gleaming bodies, and at frequent intervals the fish had to be shoveled into the hold. Yet it was a poor catch; we had landed only about 10 crans (a cran is 37½ impe-

FOR PROTECTION AGAINST SALT—NOT FIRST AID

Tightly wound bandages serve as gloves. Each season, 3,500 "lassies," varying in age from 16 to 60 years, swarm into Great Yarmouth from distant Scottish ports.

rial gallons, or 1,200 to 1,500 fish); so it was not worth while to return to port.

Throughout the morning we cruised around, as did the other drifters, questioning what luck each had, hoping thereby to learn where the best hauls had been made. The waters in the immediate vicinity of the Smith's Knoll Lightship seemed our most favorable grounds, although the shallows thereabout made shooting nets a fairly tricky business.

A RACE AGAINST THE TIDE

So close to the lightship did we finally shoot the nets that a deeply inset tide during the night bore us down toward it, with the risk of drawing our nets across its bows.

For a frantic half hour the crew hauled nets as they had never hauled before; perspiration streamed from their every pore, though the night was cold. Cutting of the nets seemed imminent. The fog signal blared closer every moment.

"Haul faster!" shouted the skipper, with an eye ever on the ominous red light. "Never mind the few fish that stick in the nets, get them out later. Haul faster!" The capstan rattled a higher crescendo.

Signals jingled to the engine room: "Stand by!" For a few moments it seemed that, to avoid a crash of the drifter against the lightship, the nets would have to be sacrificed.

Then the light slowly but surely began to fall astern. "You can take it a bit easier, boys," came the welcome order. The race against the tide was won.

With twisted smile on his face, the captain turned to me and remarked: "Well, I think you can say you've been closer to that lightship than any other American!"

In many of the nets there had been a fairly good "shimmer" of herring; so we steamed into port with nearly 40 crans of herring to be unloaded into "swills," or baskets, and then auctioned off (p. 235).

TALL AND TRUE FISH TALES

A few weeks later drifters came to port with real fish stories to tell. There were no wailing complaints of lack of fish; instead, there were dramatic tales of vast shoals moving directly over the grounds where the fleet was fishing, reports of loss of expensive gear, and of such heavy hauls that they could not be stowed away in the

holds! Even the oldest fishermen could not recall when there had been such a run. Masses of herring were literally jumping out of the water.

One Scottish drifter, fishing with more than a hundred nets, came into Yarmouth with 20 crans (between 20,000 and 30,000 fish) taken from one net. It had been the only one that the crew was able to pull aboard; all of the others were so laden with herring that they had been carried away, a loss of some $3,000 in gear alone. Other ships had varying losses, ranging from a few to most of their nets.

When hauled aboard, many of the nets had the appearance of thick silvery blankets, so closely together were the fish massed. Some of the crews, who were fortunate enough to land all or a greater portion of their nets after long hours of fatiguing labor, came into port with shots of from 100,000 to nearly 500,000 herrings. Yarmouth and Lowestoft saw incredible millions of fish for a few days.

"KNIT ONE, PURL ONE" UNTIL ANOTHER BOAT COMES IN!

When a Scottish fisher girl is not busy cleaning and packing herring, she plies her knitting needles on a new scarf for herself or a sweater for brother, husband, or sweetheart in the fleet (see text, page 247).

Yet fortune failed to smile on the fishing crews; many of the Scottish drifters were destined to return home burdened with deficits. Great Britain's dwindling export markets could not absorb the heavy glut of fish.

FISHING BY SHARES

On the English drifters a share system prevails. Profits are divided into 16 shares, of which nine go to the owner of the boat and the other seven to the crew. The captain's portion is one and three-fourth shares, the first mate and engineer each receive one and one-fourth, the oarsmen one, and so on down to the cook, who gets three-fourths of a share. On the Scottish boats the crew often own a certain number of nets and their pay is scaled accordingly.

Ashore the catch must be cured, packed, and barreled for shipment.

A comparatively small but increasing portion of the catch is "klondyked"—that is, iced fresh when they are landed—and shipped for immediate consumption. Others are converted into "bloaters," "kippers," and "reds"—all three methods of curing which originated in Yarmouth. Nearly half of all of the landings, however, are pickled for direct export. The Scottish firms are chiefly, though not entirely, concerned with this latter activity, which

Photograph by Topical Press Agency

A WRECK? NO, JUST HEAVY GOING!

In this nautical illusion, a drifter wallows in the trough of a huge wave, while another, cresting a swell, passes close by. Because of its shallowness, the North Sea in a storm piles up quickly into big, choppy waves. Drifters played a heroic rôle in the World War as patrol boats and mine sweepers.

HEAVE HO, WITH A WILL!

A basket of herring comes out of the hold to the quay. Four such baskets make a cran, the customary British measure of fish. In 1913, at Great Yarmouth's all-time peak in the herring trade, more than 824,000 crans, or, roughly, one billion fish, were unloaded at her piers (see text, page 248).

REAPING THE HARVEST OF THE NORTH SEA

Herring fishermen lead strenuous lives. This crew had been hauling nets for more than five hours when the sun peeped above the fog-dimmed horizon. If the catch is large, it often takes twice that time to pull in the heavily laden nets.

© Fox Photos

PACKED CLOSELY TOGETHER, GUNWALE TO GUNWALE, AND IN COLUMN, THE FLEET STREAMS INTO PORT

Nearly 1,000 English and Scottish drifters fish the vast herring shoals which migrate to feeding and spawning grounds in the waters about the British Isles. Curious villagers always watch from the breakwater as the tiny ships, fishing gear stowed on deck and holds full of fish, race for the narrow harbor entrance. In April they operate near Ireland and the west coast of Scotland; May and June find them in the Shetlands and Orkneys, later touching the east coast of Scotland; and then, in October, they are welcomed at Great Yarmouth and near by Lowestoft (see text, page 250)

THE TOP OF LORD NELSON'S MONUMENT COMMANDS A PANORAMA OF CURING YARDS

A portion of the fishing fleet lies harbored to unload its catch on the ribbon of the River Yare, cutting through Great Yarmouth. Although some fish are iced and shipped fresh, the major portion of the trade is in pickled herring, packed in barrels. When the city sought to honor Nelson, the town clerk, about to administer the oath on the Bible, requested: "Your right hand, my Lord."—"That," said the naval hero, "is at Tenerife."

PACKING HERRING IS WOMEN'S WORK AT GREAT YARMOUTH

The "gipped," or gutted, fish are graded to size and carefully corded in barrels with liberal sprinklings of salt. As there is some shrinkage after a few days, these lassies are adding another layer of pickled fish to fill the barrels.

accounts in part for the large staff of men and women who come from all over Scotland for the curing season.

The yards in which they work are scattered extensively along the water front and on the Denes, at the lower end of the town. As soon as the lots of herring have fallen under the auctioneer's hammer, carters truck the swills of fish to the yards and dump them into troughs, where they are "gipped," or gutted, and graded by the girls.

Working in teams of three, two for gipping and one for packing, the Scottish lassies dispose of the fish with incredible rapidity. A lightning flash of a knife and the herring is tossed back into one of the three grading tubs. Although a small matie is nine inches in length, a matie nine and one-fourth, a matfull nine and one-half, and a full herring 10 inches, seldom are the girls in error in grading them simply by sight, as they swiftly handle them. Salted first in the gipping troughs and again when they are carefully corded into their proper barrels, the fish make their own brine.

Each team handles about four barrels an hour—slightly more than a herring every second—and a working day is from ten to twelve hours long when catches are sufficiently large to keep the packers busy. Whether they work or not, each girl is paid the equivalent of about $3.50 a week as a living wage; to that is added a commis-

A THOUSAND FISH—"TWENTY-FIVE SHILLINGS, WHO'LL MAKE IT TWENTY-SIX?"

As soon as a herring catch has been landed at Great Yarmouth, it is auctioned off. Price calls are based on the cran (37½ imperial gallons). The herring season attracts English and Scottish buyers, and agents from far-off Greece, Germany, Russia, and other European countries.

sion on each barrel of fish she packs. These commissions are divided equally among the three members of each team.

The kippering rooms present similar scenes of activity, except that in preparing the fish each one is "speeted," or slit through the back, and spread out for a brief salting and smoking. From the brine tubs the speets are put on racks and hung in the smoking rooms on narrow racking partitions, called "louvres." Kippers receive only a brief salting and smoking; "reds" require a longer treatment.

The famous Yarmouth bloater is a lightly salted, briefly smoked, whole herring, prepared for immediate consumption.

When they are not busy with knives in the curing yards, the girls are industriously occupied with their knitting needles. Never have I seen such knitters! As they walk up and down along the water front, sit in knots on the packing barrels, or ride to and from their rooming houses, knitting needles are always active (see page 241).

How many bright-colored jerseys and scarfs they knit to replace the ones that become worn and smeared with fish scales; how many sweaters are knitted for husbands and brothers of the drifters, only an untiring statistician could contemplate. Even in the town social rooms you see the women knitting. Only at night, when the lassies have exchanged their rubber aprons, boots, and bright head scarfs for trim

A CREW UNLOADS A SILVERY CARGO

When herring runs are bountiful, many drifters return to Great Yarmouth with 100,000 to 400,000 fish in their holds. Fast work is made of unloading to permit an early return to the fishing grounds (see text, page 241).

gowns, silk stockings, and high-heeled shoes, to go window shopping in the town or to a dance, do they seem to be able to lay aside their knitting.

One morning I stopped to get a photograph of a group of the girls as they were binding up their fingers with strips of cloth as a protection against the irritating effects of the salt on the fish (see page 240).

"Take a picture of me?" joked one. "Had I known you wanted a picture of me, I'd brought me compact along."

She certainly needed no rouge, for her cheeks were pink from long hours each day in the open air.

"What's the picture for? A paper? And are you going to call us buxom, like the pressmen have?" questioned another.

Perhaps buxom is not the proper word; but, whether 16 or 60 years old, they are the healthiest group I have ever seen. They have to be!

"It's American ye are?" ventured a third, and then movie-born slang descended on me in an avalanche of "Oh, yeah's" and "You're telling me's," amid peals of laughter and cross-conversations of incomprehensible Gaelic.

In the net chambers of one of the local firms I found girls busy making and repairing nets, and in other rooms I saw the ransackers overhauling the gear, replacing missing cork floats, and getting the nets ready for sea.

Almost everywhere one turns one sees still other activities linked with the fishing industry. For instance, there is the handling of from 15,000 to 20,000 tons of salt that is imported, unloaded, and distributed to the yards in an ordinary curing season.

In near-by Lowestoft I visited the research laboratories where the scientists of the Ministry of Agriculture and Fisheries are carefully studying the migratory, spawning, and feeding habits of the herring shoals, as well as the influence that harmful organisms may have upon the annual return of the fish to their normal grounds.

A BILLION FISH CATCH

Great Yarmouth's all-time peak in herring fishing came in 1913, when more than 824,000 crans, or somewhere about one billion fish, were unloaded on her piers!

ALL'S INDUSTRY ON THE GREAT YARMOUTH WATER FRONT

Against a background of masts and steaming funnels, longshoremen and crews land the catches, auctioneers cry for bids, and carters bring high-piled loads of "swills." Although somewhat changed to-day, the quay still has the same bustling atmosphere as when David Copperfield watched these two-wheeled carts clatter over the stones (see text, page 233).

THE RAGING NORTH SEA EXACTS ITS TOLL

Returning through high seas to Great Yarmouth with its catch, this Scottish drifter crashed into a pier at the river's mouth and sank. As the ship breaks up under the pounding of the surf, gulls hover above to feast on fish released from the hold. The crew and expensive nets were brought ashore safely.

In 1932 the landings of herring in all of Great Britain's ports came to an aggregate of 1,459,988 crans, valued at about $10,000,000. Add to these already stupendous figures the countless billions caught by Dutch, French, German, and other fleets, not only as full-grown herrings, but as whitebait and sardines, and one asks, "How soon will the herring shoals be depleted?"

For more than a thousand years, however, fishing has gone on over these same grounds without apparent diminution. Although it is estimated that from 8,000 to 10,000 miles of British nets are fishing in the North Sea at one time, yet but a fraction of the fish ever become ensnared.

The spawn of a normal full-grown herring averages from 30,000 to 47,000; so, even though it is probably more extensively preyed upon than any other fish, its progeny will continue to stock the seas abundantly.

During the years of the World War, when practically all the fishing boats were on patrol or mine-trawling duty, the herring shoals had further opportunity to increase. Lack of markets, not lack of fish, will continue to be the chief source of worry of the herring-fishing industry.

So, year after year, despite unstable markets and fluctuating prices, many of the hardy Scottish and English fishermen will go to sea. Now they ship aboard the *Ocean Angler, Busy Bee, United Friends, Braes o'Enzie, Ocean Sprite, Children's Trust, Green Pastures, Violet and Rose,* and other steam drifters rapidly becoming obsolete. In the near future, perhaps, they may be hauling their nets over the gunwales of new Diesel-engined ships bearing equally whimsical names.

Every season they will keep the same rendezvous as did their forefathers—April, it will be Ireland and the west coast of Scotland; May and June, it will be the Shetlands and the Orkneys; later, they will touch the east coast of Scotland; then, in October, the cycle will again be completed, when Great Yarmouth and Lowestoft welcome the herring fleet.

"COMPLEAT ANGLER" FISHES FOR FOSSILS

By Imogene Powell

With Illustrations from Photographs by the Author

THERE is one feature of fossil-fishing which sets it apart from all other angling sports—the big ones can't get away!

This fact, and also the minor one that fossil-fishing in this country must be carried on in the remote, not to say obscure, portions of the United States, will probably keep it from assuming the place which it deserves as a major American outdoor sport.

The proper fossil-fishing trip leads you, for example, to Fossil, Wyoming, where you may be the only person getting off there that year!

Now, the *Priscacara pealei* (poor fish to you!) may look tame enough as you pass him by in a museum on your way to the stuffed owls; but that is because these ancient relics of prehistoric days have been carefully caught for you, imprisoned in their stone frames, labeled, and hung where they can excite only the inflammable interest of the paleontologist.

But try fishing some time for those rovers which, only a few million years ago, "when you were a tadpole and I was a fish," swam blithely through that inland ocean where are now the Rocky Mountains.

A WEEK-END FOSSIL "CATCH"

One week-end fishing trip in Wyoming may net you a six-foot palm leaf, three large pickerel, bass, or pike, a prodigious mosquito (just the way you'd like to see a mosquito, transformed into solid rock), sunfish, herring, the thick-scaled gar pike.

Then, you never know when you may come upon an ancient crocodile 13 feet long. One was found near the fossil bed, where you must look if you expect your week's sport to be really exciting.

Fossil, Wyoming, is formed by the accidental meeting of two roads which slipped down from opposite sides of a mountain. There is a pleasing legend that the population of Fossil is 50; but, counting the people you can see and the ones you can imagine, you cannot arrive at a generous estimate of more than 30. There are four regulation buildings, and there is a box-car fitted up with chintz curtains and bespangled with cooking pans. The foreman of a section gang lives there. A sheep herder's summer home, neat barrel staves covered with sheeting, stands at the corner of State and Madison (see page 253).

They will have to stop the train especially for you. They don't like to do it—and, as you look out over the wind-swept, cold, purple dawn on the Rocky Mountains at this particular point, neither do you.

But it's worth it!

ASLEEP IN A DISTANT PAST

A few minutes after you have arrived on a well-conducted fossil-fishing trip, the sun will break over the farthest ridge in a long crescent of fossil mountain which sleeps content in a past which even the most arduous fisherman will never know.

Around you is a shallow sweep of mountain—red, gray, green, blue, and purple—colored with time and embracing earth and sky and air. The sky is a curious translucent blue. You stand as if on the basin of some huge broken piece of pottery. All about you at the broken brim are fossil beds which you may fish to heart's content and whose depth you may never plumb.

Custodian of the fossil beds, amateur sportsman extraordinary, Robert Lee Craig will take you fishing if you have an honest interest. He has been fishing in these hills for 37 years, and he has no patience with people who will not climb with him the 275 feet from his camp to the fossil hill; who will not wait while he lays bare a stratum of fossil rock; who will not, with his own suppressed excitement, cleave those strata again and again, peeling, stripping the layers down as though they were ears of corn. Often the finest specimens of fossilized fish will be hidden just beneath the gray-white surface and would pass notice of all except the most observing (see page 257).

It is best to wait until the heat of the day to raise a ledge, for then the bright rays of sun, striking each layer as it is peeled off with wedge and hammer, often show up the faint tracing of a backbone, the dim outline of a fin.

When this outline is revealed, the fossil fisherman takes the sharp blade of a knife and gently scratches the protecting shale away to make sure of his specimen. Then he hews out a square of rock around the

FOSSIL-FISH STORIES CONCERN AGE RATHER THAN SIZE!

Paleontologists estimate these to be approximately 55,000,000 years old. The long, slender fish has many fossil contemporaries in the dusty mountains of Wyoming, but only one species lives to-day, in the South Pacific. The other is a herring.

fish, and the specimen is ready for cleaning. The cleaning process is done with the fine blade of a knife, great skill being exercised to clear away all trace of rock in which the fish is embedded without destroying the delicate outline of the fish.

CLEANING FOSSIL FISH THE WORK OF AN ARTIST

Through the years Craig has become highly skilled in this art. He waits a certain number of hours after the fish has been raised, so that the slightly damp rock will give properly to the knife blades, and yet so that sufficient air will have struck the specimen to keep it well preserved during the process of cleaning.

To raise the strata, to cleave those gray-stone squares—most often they are about six inches thick, though some are much thicker—requires strength and a certain skill easily acquired by the amateur. But to clean fossilized fish the skill of an artist is required.

This master fisherman skins them in the record time of 20 minutes—can clean them so that the tiniest fin, the most delicate scale, will stand in bas-relief. Sometimes he scrapes away the stone around the fish so that it lies against a frame. Sometimes he cuts an irregular outline about them—each fish to its setting.

If you go to Fossil to fish, you will most certainly not raise a fish the first day. That is contrary to the whole custom of fishing the world over. No, the first day must be one of disappointment—of a long, sharp climb up barren rocks, of sliding on heaps of shale, of digging out mountains of broken rock which nighttime, winds, and a passing sheep herder have shoved down onto a layer which just the day before has been prepared for raising for your special benefit.

These fossil hills are contrary—jealous as deep pools where bass lie hidden from the caster's fly. They slip and slide, they shift and fall, to confound the fisherman and make for him unceasing labor. You must wait and hope, you must listen to stories of other fish, other days; you must eat your noonday sandwich dry and brittle and filled with some dust of shale; you must know the sadness of cleaving a whole sheaf of rock at last—good, firm fossil rock in which whole schools of prehistoric fishes should lie buried—only to find it barren as

a desert trail. No, these fish took one more dive before the cataclysm. They lie to windward or to leeward. And though you are some 25 or 30 feet below the top layer of protecting shale, still you have not fished deep enough.

"FISH" ON DUSTY MOUNTAIN TOPS

If you are a proper fisherman, you will of course spend many lingering moments which might otherwise be tedious in contemplation of the ancient story of how your "catch" came to be cast up, in the very act of living, onto the dry and dusty mountain tops. As a theme for meditation, it far surpasses the habits of the lively pike in his favorite deep-lake retreat. For the how and the why of the northern pike in present-day waters is mysterious enough, but the how and the why of the fossil gar pike is the story of Time itself.

THE COVERED WAGON IS ONE OF FOSSIL'S FEW RESIDENCES

This crossroads settlement in southwestern Wyoming, according to legend, has a population of 50, but the author estimates not more than 30. The "town" has four regulation buildings, a box-car, and a sheep herder's simple summer home on wheels (see text, page 251).

Perhaps the best definition of the fossil fish for the amateur stone fisherman is the simple one given by the late Frederic A. Lucas, formerly a curator of the National Museum, in his book, "Animals of the Past."

"Fossils," he says, "are the remains, or even the indications, of animals and plants that have, through natural agencies, been buried in the earth and preserved for long periods of time." These "indications," which may be footprints, tramped leaves, the almost formless jellyfish, the very ripple on the sands, have been, in many instances, preserved in stone, perfect patterns of the ephemeral life of millions of years ago.

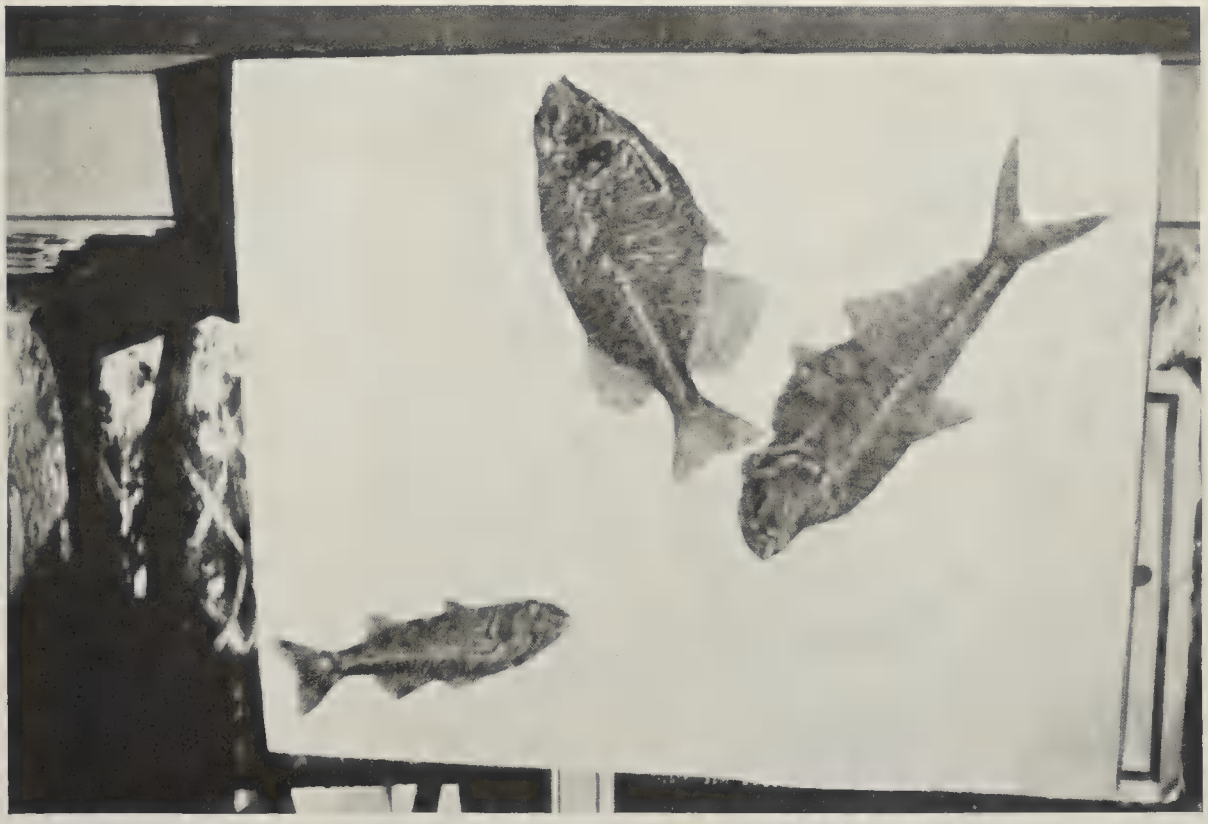
And how did fossil fish come to be imprisoned in their strangely lifelike stony form in the Rocky Mountains of Wyoming? Your mind must go back to lost ages, when an ocean rolled over the wheat fields of Kansas, the prairies of Nebraska, and the site of the Empire State Building alike. These abundant seas were ruled successively by various races of sea creatures, which came, ruled, were conquered by larger and more powerful species, and at last lay scattered at the bottom of the ancient ocean bed.

STRANGE OCEAN CREATURES

Among the strange ocean rulers were the armor-clad fish; then, in turn, the fierce, sharp-toothed sharks, the fish lizards, the mysterious ichthyosaurus, the

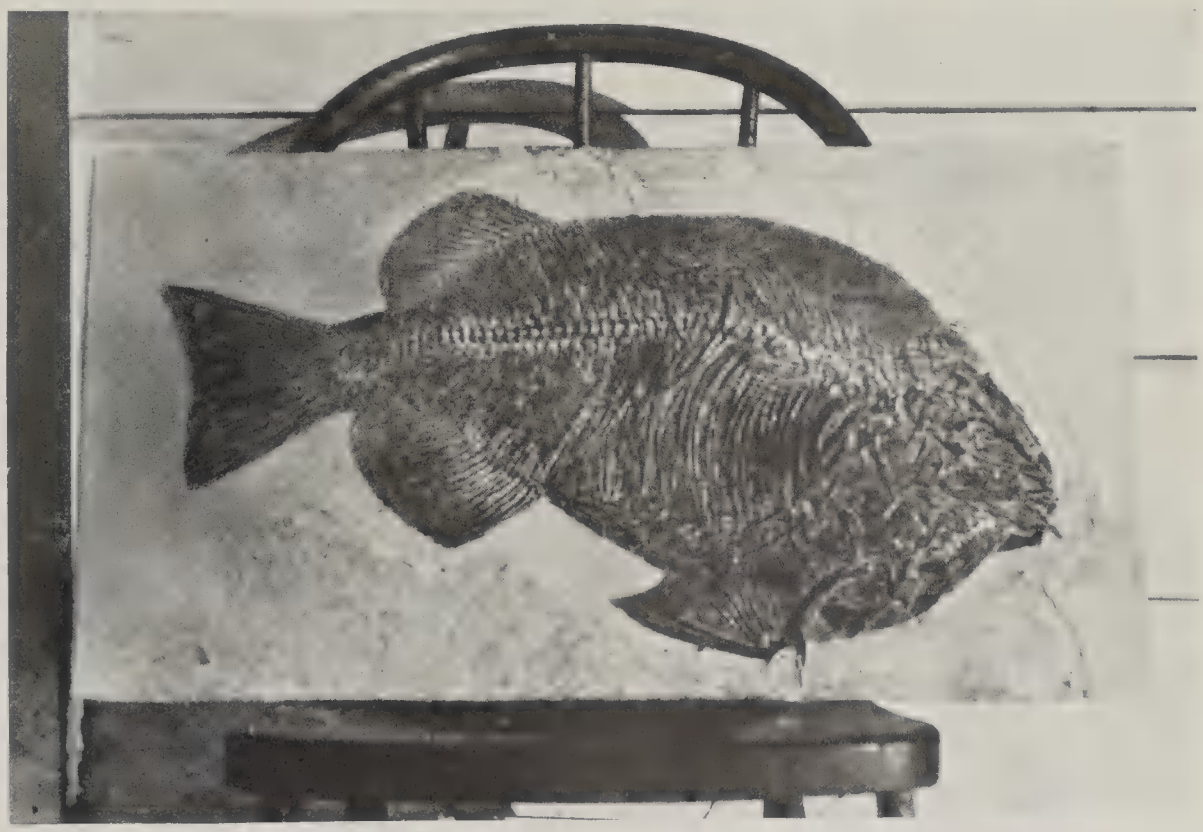
THE AUTHOR EXPLORES THE FOSSIL-FISHING GROUND

Many specimens of plant and animal life that flourished ages ago were buried and perfectly preserved in the ooze of a lake bed which now is this hill of stratified rock. The deposits have escaped destructive land disturbances, and erosion has made easily accessible the richest fossil area in the United States. A week-end "catch" may net a herring, bass, or some other fish, a six-foot palm leaf, a prodigious mosquito, or perhaps even an ancient 13-foot crocodile, all turned to stone (see text, page 251).



ONE "CAST" HOOKS THREE BIG ONES

Not often does the splitting of a single slab of rock so abundantly reward the fossil hunter. Nature has mounted in stone a herring, a *Dapedoglossus,* and a basslike fish. Carbon in the bodies causes them to show up dark against lighter-colored shale.



HIS COUSINS STILL SWIM IN THE RIVERS OF FOUR CONTINENTS

This unusually large *Dapedoglossus* is one of the finest "strikes" that Robert Lee Craig had while quarry fishing. Of the five living species of the family to which this extinct member belongs, one is found in Australia, another in the Malay Archipelago, a third in tropical Africa, and two in the Amazon—one being the pirarucú, the largest fresh-water fish in the world.

"COME ON OVER; WE THINK WE'VE GOT ONE!"

Peeling away the layers of this slab may reveal a rare fossil prize or be as fruitless as whipping a trout stream on an off day. Should the faint tracing of a backbone or a fin appear, the protecting shale is scraped away carefully with a fine knife blade, exposing one of Nature's "reliefs."

plesiosaurus, whose names are only a little less terrifying than the havoc they spread among the fish lizards crawling in the mud of ocean bed. The great marine reptiles called Mosasaurus, geologists believe, ruled the seas from New Zealand to North America at one time. These ancient reptiles, at their most fearsome prime, measured from 25 to 40 feet in length.

The Rocky Mountains—so placid and gray now by daytime—swarmed with heroic battle in the days when they were still ocean bed. Huge turtles, saber-toothed divers, the monstrous fish of legend, all fought for supremacy, and over the waters flew the pterodactyls, dark, menacing shadows, with their powerful wingspread of 20 feet or more.

While the rival fish species spawned, fought, and died, the surface of the North American Continent was gradually taking form. The land which made up the ocean bed was rising with monumental slowness — an inch, perhaps an inch and a half, a century.

At last the "ocean" on the North American Continent was completely enclosed on the west and on the east by elevations of sea bottom, so that it connected with the Atlantic and Pacific Oceans as we now know them only at the Gulf of Mexico and the Arctic Circle. Continued elevations of the eastern and western edges contracted the area of this vast inland ocean, and parts of the ancient sea bottom rose, reached the surface, forming bars and vast fingers of land. Parts of the water area were contracted into inland lakes until, at last, they lost all contact with salt water.

Thus the living creatures—the turtles, the great saber-toothed fish, the gar pike—were imprisoned in fresh-water lakes. The weaker tribes perished slowly, tribe by tribe, lost to their salt-water habitat. With the death of many of the smaller, weaker tribes of fish, the main food supply of some of the larger and more ferocious sea creatures was diminished, and they, too, perished, hapless prisoners in their trap of earth.

Even though millions of creatures lived and died in the oceans which through the natural geologic change of time became mountains, lakes, and valleys, comparatively few fossils remain to tell the tale. In order to fossilize, objects must first be

protected from the air completely. Nature accomplishes this only by burying them in wet ground.

The fossil fish must first have settled to the ocean or inland lake bed. He must have found quiet waters, after his life's struggles, where the wash of waves on the shores would gently wear away the sand or rock. This pulverized rock or sand must then have settled gently over the fish. His bones, little by little, must have been covered by a fine deposit which would embrace every fin and scale, fill every groove so gently as to preserve each delicate outline.

Every schoolboy fisherman, questing with a bent hook in the old mill-pond, has pulled out from the sucking mud some old shoe or tin bucket. The sea creatures of millions of years ago settled first into the mud much as the old boot does — and the first stages of their fossilization had begun.

"FISHING" WITH CHISEL AND HAMMER

For 37 years Robert Lee Craig, as amateur sportsman extraordinary, has been angling patiently in the rocks at Fossil, Wyoming, to provide fossilized fish for museums and private collections. Here he cleaves a slab of shale, finding several valuable specimens (see text, page 258).

The crust of the earth was rising and falling, just as it is to-day, and the layers of mud in which the fish were buried became increasingly thick. The lime, or silica, in the water cemented the particles of mud and the grains of sand into a solid mass, a process speeded by the constant slow pressure of the overlying sediment, the heat created by this pressure, and likewise the heat from the earth beneath.

NATURE "MOUNTS" A FOSSIL

During this process of slow burial, solidification of rock, and pressure from the earth below and above, the animal matter of the creatures embedded disappeared completely. The place of flesh and bone and fin was taken by the lime or silica deposit, and the hardened rock surrounding it formed the layers which millions of years later were to emerge as fossil rock, a perfect protection for the fish buried there. The chemical change which produced this metamorphosis in a fish of flesh and scale is a fit subject for a fisherman's solitary speculation. The exact manner is unknown, even to the geologist, and the transmutations through which the ancient gar pike went before he emerged a perfect fossil specimen could have been achieved only by the patient alchemy of ages.

Worsted in some encounter with a stronger gar pike, he went to the bottom of the sea—a Mr. Hyde of corruptible flesh and fin. He emerges millions of centuries

later—Dr. Jekyll, the image of himself in stone.

Even after mutable Time had caught him unaware, the gar pike, in fossilized form, had still only the remotest chance of coming anywhere near where the zealous fisherman could get at him. After he was transmuted to stone, Nature must still make the contents of the fossil rock accessible by turning the strata on edge. This she did in her own peculiar fashion, by volcanic eruption, by heaving and buckling the fossil strata into cliffs and mountain edges, or by cleaving them into valleys and canyons.

Some fossil strata are lost forever to the prying human eye through too great an upheaval of Nature and the flattening out of other strata on top of them. Sometimes they are cracked by heroic movements of rock, and, if the fossil strata are cracked open and left to the mercies of sun and wind, snow and frost, these, their natural enemies, will quickly obliterate the fossil specimens.

The chances a fish has to attain immortality as a fossil are one in a million. And that is why, when the fossil fisherman is in sight of a "catch," he feels very Eternity tugging at his line.

The sun sends long dun and purple shadows into the hollowed mine where you fish. You could not discern a fishbone, fin or backbone, in the gray rock even if you worked on. A cold and penetrating wind warns you that the day is done. There is the steep path for your tired feet—275 feet straight down, with dizzy depths of shale below you—then a long, winding, two-mile hike to town.

At the general store they ask you, "Any fish to-day?" You shake your head and hurry to the hotel, where supper is waiting and the white-haired lady, who has prepared three hearty meals a day for 30 years against the coming of a crowd of sheep herders, does not even ask you about your luck.

Well—to-morrow, perhaps!

That is the way with fossil fishing. You go back to-morrow. R. Lee Craig has gone back each to-morrow for 37 years, despite the fact that he has just one leg and must climb the sheer mountain sides maintaining an uneven balance with a gnarled wood stick which serves him as a cane.

Fish that were raised from this same hill have gone to museums in all parts of the United States and in foreign lands. Geologists and paleontologists have visited Fossil and are counted among the personal friends of Mr. Craig. He has prepared what is considered the largest collection of fossil fish in the world for a Chicago collector.

HIS "TACKLE" IS PICKS, SHOVELS, AND HAMMERS

Lee Craig has the ideal attributes of an angler. He is patient. He knows his wedges, picks, shovels, knives, hammers, and hack-saws as a sportsman knows his tackle. He handles them unfailingly, wedging into the soft rock with a sure touch, hammering here, cutting there, working with the soft and treacherous stone so as not to harm any specimens which may be hidden in those gray depths.

He has a certain indomitable spirit which has kept him fishing in those mountains all this time. He knows them so well that, walking up his trail and across the shifting edges of the fossil beds, where rock lies piled feet-thick, he can tell whether a stranger has passed that way. He knows by the rocks in the path, he says. "Tenderfoot! Only a stranger would kick shale in his own path!"

Craig discovered his own particular fossil hill and his life's work on his way from Shoshone Falls, Idaho, to Laramie, Wyoming. He had some little previous experience digging fossils with his friend, Fred Brown, leader of expeditions which contributed dinosaurs to the Smithsonian collection. He had helped uncover the bones of that famous brontosaurus, that massive prehistoric creature which in life, it has been estimated, weighed as much as 20 horses. He saw what looked to be a field rich in fossils, and though he'd never seen the town of Fossil before, he asked the conductor to unload him here. And here he has stayed.

INDEX FOR JANUARY–JUNE, 1934, VOLUME READY

Index for Volume LXV (January–June, 1934) of the National Geographic Magazine will be mailed upon request to members who preserve their copies and bind them as works of reference.

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FLYING AROUND THE NORTH ATLANTIC

By ANNE MORROW LINDBERGH

With a Foreword by Charles A. Lindbergh

Foreword

TRANSOCEANIC routes constitute the last major problem in the development of the airlines of the world. The great distances between land on all routes south of the Arctic and the difficulties of climate and short hours of winter daylight on Arctic routes have combined to delay the inauguration of scheduled air services between the Eastern and Western Hemispheres.

The development of aircraft has now reached a point, however, which makes commercial transoceanic flying feasible. Consequently, the study of transatlantic air routes has become of immediate importance. Our flights around the North Atlantic in 1933 were for the purpose of studying the bases which might be used and the conditions which would be encountered along the various possible air routes between America and Europe.

The northernmost of these is through Greenland and Iceland. The most direct from New York is through Newfoundland and Ireland. The shortest water distance south of the Arctic is from Newfoundland to the Azores. More desirable climatic conditions would be met by flying over Bermuda and the Azores. The latter would be the southernmost route which would be practical for a commercial airline between the United States and Europe. The largest part of the South American traffic would probably be by way of Africa.

It is interesting to note that where distances between land are the shortest, the climatic conditions are most severe. Consequently, the great advantage of the Greenland route from the standpoint of frequent bases and refueling facilities must be weighed against the extreme climate, while the attractions of a more southerly route must be largely discounted due to the much greater distances between land.

A commercial airline must eventually pay its cost of operation from the revenue received from the load it carries. Therefore, it is desirable from an economic standpoint not to have refueling bases too far apart. Every additional mile which must be flown without refueling means that more fuel and less payload are carried.

It seems probable that methods will be perfected to refuel planes at sea in the future. They may be refueled from a ship or on a landing platform or from another plane in flight. All of these possibilities must be considered.

Climate, harbors, airport locations, floating bases—these and many other problems must be studied in relation to practicability and economy of operation before an air route is finally decided upon. Even then it is necessary to visualize as far as possible the future development of aviation. For a route which is the most practical for aircraft of to-day may be made obsolete by aircraft of to-morrow.

Intermediate facilities which now seem desirable may be made unnecessary by the long ranges and higher efficiencies of future aircraft. Any of the transatlantic routes

can be flown regularly. It is no longer a question of whether it is possible to operate an airline across the Atlantic—rather it is a question of which route can be flown now, and in the future, with the highest degree of efficiency.

In equipping for our flight it was necessary to select, first, the equipment which would be required for the normal conditions we would encounter, and, second, the equipment which would be necessary in case of a forced landing. The latter had to be subdivided into that which would be necessary in case of a forced landing at sea and that which would be necessary for a forced landing on land.

Our plane, the *Tingmissartoq,* is the same which we have used on various flights in the United States and in which we flew to Japan and China in 1931. It was built in California in 1929. As emergency equipment for a forced landing at sea, we carried a specially built collapsible rubber boat with waterproof cover and a small sail, a waterproof radio set, eight gallons of water, food for several weeks, sextant, and other articles of equipment and clothing. Under ordinary conditions we could have abandoned our plane at sea and existed for at least a month after doing so.

Our most difficult problem for an emergency landing was the possibility of being forced down on the Greenland ice cap. On our flights in Greenland, we were prepared to walk halfway across the ice cap if it became necessary. This equipment consisted of a sled in three sections, snowshoes, six weeks' food, heavy clothing, and many other articles. We also carried full hunting and camping equipment, so that we could have lived comfortably for an indefinite period wherever game was available.

In all, there were several hundred articles of emergency equipment. We planned first to avoid as far as we could the possibility of forced landings; second, to equip to meet them under any combination of circumstances.

CHARLES A. LINDBERGH.

Photograph by Acme Newspictures

"ALL SET"

Charles and Anne Lindbergh, in the cockpits of their Lockheed Sirius monoplane, about to be shoved down the ramp at Glenn Curtiss Airport, Long Island, New York, for the start of their aërial circumnavigation of the North Atlantic, July 9, 1933.

FLYING AROUND THE NORTH ATLANTIC

By Anne Morrow Lindbergh

"TOOK OFF FLUSHING BAY 03:37 —JULY 9th 1933."

It was a hot afternoon, the kind on which one looks at the sky from time to time for ripening thunder storms. My husband was already at the airport making the last tests before our departure.

When I arrived at three o'clock the red-winged plane stood on a cradle at the head of the ramp leading down into the water. It was surrounded by a circle of photographers' tripods, cars, movie trucks, and a small crowd of onlookers. My husband, standing in the cockpit, signaled above the crowd that everything was ready.

The emergency equipment and our two blanket rolls of clothing had already been stowed away in the baggage compartment. I handed up my coat and a folder of radio papers, pads, and pencils. I jumped on the cradle, up onto the pontoon and then onto the wing. Here I always had to stop and turn around. It took three more steps to get up into my cockpit—left, right, left, over the steel steps which slid out of the fuselage.

RADIO, MAPS, AND A SHELF

Once in my cockpit, everything appeared much as it had on our trip to the Orient. I settled down in my seat and looked around. There were, of course, the dual controls which had been in the ship since it was first built; the stick between my knees, the rudders at my feet, and the throttle and stabilizer control at my left hand. To the right and a little back of my husband's seat, where we could both see it, was an aperiodic compass. This completed the flying equipment.

But on this trip I expected to do much more radio work than flying. The transmitter key was on the right side of the cabin, in easy reach of my right hand. Below it on the floor was the box of transmitting coils which were plugged into the set to change the frequency. Leaning forward a little, I could reach the receiving set, about halfway between my husband's seat and mine. The top of its case formed a convenient shelf on which to pass notes and sandwiches up to the front cockpit.

On the other side, at my left shoulder, was the aluminum map case in which we kept almost everything: maps, pads, pencils, an extra pair of earphones, gloves, helmets, a sweater, cotton wool, rags, twine, and our sandwich lunch. (Nothing but sandwiches would fit. I once regretted putting in a pear.)

In front of the map case, facing me, was the transmitter; below it, the fair-lead and antenna reel.

On this same side, behind my seat on the floor, the dynamotor was installed. Behind and to the right of my head was a condenser for the loop antenna. The loop antenna was wound around the inside of the fuselage behind my seat. There was also a "B" battery box on the floor under the receiver.

All this equipment was the same as that used on the Orient trip. You would not think there was room for anything else. But there was. For this trip the Gatty drift and ground-speed indicator was installed on the right-hand side, somehow deftly avoiding coil-box and transmitter key, which were both in the same general vicinity.

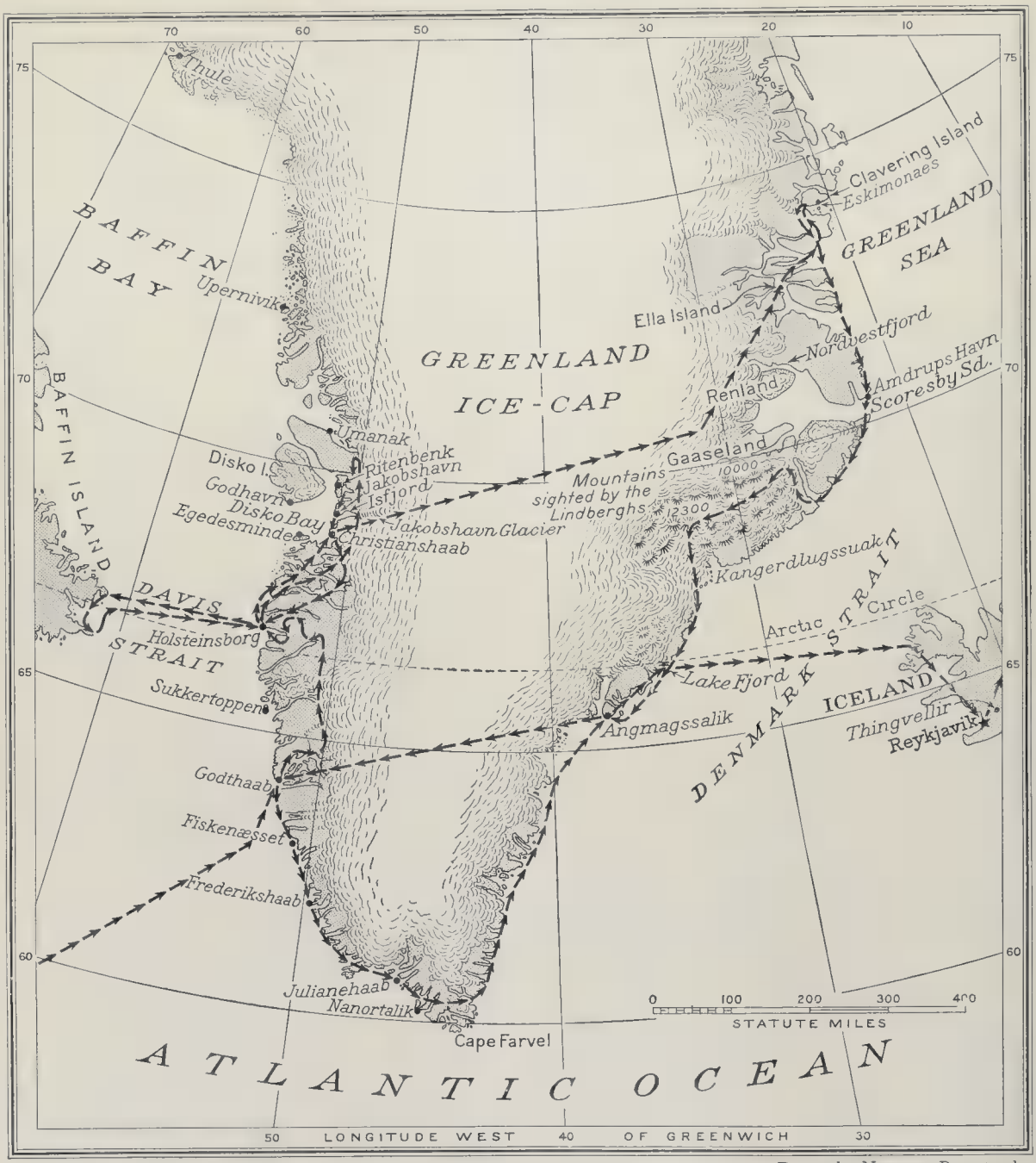
There was one other thing. Instead of a parachute to sit on, we had, this time, air cushions. We were not doing night flying and the parachutes, we decided, would be of little value over the ocean or over the Greenland ice cap, where it would be impossible to live without having the emergency equipment from the plane. We also had life preservers which we could inflate for use when taking off or working on the plane in deep water.

After a glance around the cockpit, I tied on my life preserver and blew it up. Next, I fastened my helmet and the safety belt. Then I looked out.

"UP ON THE STEP"

The ship was being pushed down the ramp, mechanics on each side guiding it. The movie-tone trucks behind us were taking their last shots. "Hey! Look this way!" — "Give us a smile!" — "Wontcha wave at us?" Shouts on all sides of us. We were watching the cradle, below us, approach the water. One more push.

"This one will make it," I heard a mechanic say, and we slipped into the water. The engine, which my husband had idled as we went down the ramp, quickened to a roar as though feeling its power.



Drawn by Newman Bumstead

THE LINDBERGHS CHANGED THE MAP OF "GREENLAND'S ICY MOUNTAINS"

Ranges never before charted were discovered, as their red-winged plane roared southwestward along the rugged eastern margin of the world's largest island. They are drawn in here at the right, just below Gaaseland, from the Colonel's own terse description, scribbled in pencil on his charts: "High range, maximum height 12,300 feet by altimeter corrected for sea-level pressure at Angmagssalik"; and again: "Snow-covered range about 10,000 feet." The Lindberghs found mountains extending about 100 miles inland at that point instead of about 30 miles, as shown on maps. Eloquent arrows show, too, how they crossed Davis Strait back to barren Baffin Island, twice traversed Greenland's great interior ice cap, flew up to Clavering Island, their "farthest north," and finally winged on to Iceland, bound for Europe.

It was a long take-off, for we were heavily loaded with fuel. I held my arm over the map case as the force of the wind, when taking off with both cockpits open, was terrific and would blow everything out. First, that surge of spray, and for a few seconds the plane seemed not to be making much headway. Then the spray fell below us. We were "up on the step." Then the quickening spanks as the pontoons hit the waves—one, two, three, four. Suddenly, imperceptibly, they smoothed out into a long roar.

We were off. I pulled back my hatch,

Photograph by Keystone-Underwood

THE COLONEL PICKS UP A MOORING BUOY AT HALIFAX

Members of the Royal Canadian Air Force help moor the plane to one of their buoys, which is carefully covered with a rubber tire to prevent its denting the pontoon. Here the engine was carefully checked and more fuel taken aboard.

shutting out the noise and wind, and looked down. We were over the river now, ferry boats and barges slowly cutting their tracks in the water below. There were other planes in the air I had not noticed before—photographers trying to get close-ups.

We banked to avoid a plane crowding uncomfortably near our left wing, only to find two others we had not seen still closer on our right. One of them seemed to miss striking us by a few feet only.

Never again on our entire trip did we come as close to having a serious accident.

I reeled out the antenna and started to call WCC (Chatham, Massachusetts). My eyes on the pad on my lap, a pencil ready for messages, the rest of the trip slipped by under me, hardly noticed. We were bound for North Haven, Maine. I knew the way very well and only looked up now and then to familiar scenes. Little white sailboats on the Sound—storms—New Haven—Hartford. The next time I looked up—Lowell, Massachusetts. Then the coast and low fogs. Appledore Island, that gray slab of stone, out to sea.

It was clear at Portland. Then we hit a sea fog and started inland where we were sure to find better weather. My husband tried two or three times to work back to the coast. Then, shaking his head, he picked out a nice long pond, circled a few times and landed. We strung the antenna out on the wing and called WCC, telling him where we were. "Forced down by fog. Landed South Pond, Maine, 6:38 p. m."

THE BIRCHES AND PINES OF MAINE

This was our first chance to use the outboard motor. My husband pulled it out of the baggage compartment and attached it to the spreader bar between the pontoons. Very quietly and slowly, as if blown by a little wind, the big red-winged plane slipped in toward shore.

"Well, I guess these folks are the Lindberghs," we were greeted as we stepped on

Photograph by Charles and Anne Lindbergh

THE SEAPLANE HALTS "DOWN EAST" BEFORE HEADING NORTHWARD

This was the last anchorage in the United States. Here, in the Fox Islands Thoroughfare between North Haven and Vinalhaven, in Penobscot Bay, the same plane anchored in the same place before the Lindberghs started for China.

dock. That night we were made at home in a summer camp among birch trees and pines.

"You have been all over the world," our host said to us. "Do you know any finer place to live than Maine?"

"No," I was ready to say quickly.

Certainly on all the rest of the trip we were not treated more hospitably nor, I must add, did we meet anyone who delighted me as much with her charming frankness as an old lady who climbed up the steps to the porch the next morning.

My husband was out on the plane, but she came up to me cordially. "I would like to shake hands with Mrs. Lindbergh—though I'd much ruther shake hands with her husband!" Happily, she was able to, a few minutes later.

OVER BEAUTIFUL NOVA SCOTIA

The next day we flew from South Pond to North Haven and on July 11 left the Thoroughfare, where we had anchored, for a short flight of a little more than two hours to Halifax, Nova Scotia. My husband refueled and checked the plane that evening with the assistance of the Royal Canadian Air Force.

We took off the next morning for St. John's, Newfoundland. After five hours of flying along the beautiful coasts of Nova Scotia and Newfoundland, we circled over the cliffs of St. John's harbor and landed at 20:44 G.M.T (Greenwich Mean Time) in Bay Bulls Big Pond, a short distance south of the city.

"THE END OF THE WORLD"

We planned to leave the next morning for Cartwright, Labrador, and hoped to see Balbo and the Italian flyers who had just flown across from Iceland, but a thick fog kept us from starting until the following day. After refueling at Botwood, we arrived at Cartwright, where the *Jelling*, the Pan American Airways expedition ship, was waiting for us, at 20:57 G.M.T., July 14.

When we arrived at Cartwright, I had a vague impression that it was the end of the world. The physical appearance alone was rather desolate; the low mountains, unspectacular after the great cliffs and bluffs of Newfoundland; the scrubby pine trees; the

Photograph by Charles and Anne Lindbergh

THE SHAGGY BLACK DOG'S PICTURE GRACES A NEWFOUNDLAND POSTAGE STAMP

Newfoundlands, renowned for life saving, are often harnessed between the shafts of light carts. They are a common sight on the road from St. John's to Bay Bulls Big Pond.

rocky shore; the gray water—all combined to give an impression of bleak monotony.

The town itself was unprepossessing—a scattered group of whitewashed houses; a steeple; a fenced-in graveyard on the hill, in which we saw one day a monument to George Cartwright, the founder of the town, "who paved the way," according to the inscription, "for the introduction of Christianity to this benighted people"; and, across the bay, the Grenfell Mission buildings.

We knew, of course, that Cartwright was one of the centers for Sir Wilfred Grenfell's splendid medical and educational work on the Labrador coast. But we still felt that it was a very quiet place. We soon found out our mistake.

General Balbo's whole Italian squadron had just come and gone the day before. Signs of the excitement were still visible when we arrived. The *Alicia,* their gleaming white yacht, was still there and its small seaplane was anchored in one corner of the harbor. Strings of flags were flying in celebration from the three big boats, the *Jelling,* the *Alicia,* and a salmon refrigeration and canning boat, the *Blue Peter.* A huge pile of empty gasoline cans on the Grenfell Mission dock was rapidly diminishing, for the natives of Cartwright had discovered their usefulness.

A WEEK IN CARTWRIGHT

But it was the life of Cartwright itself, centered about the main dock, which changed my opinion. For we were a week in Cartwright, making one reconnoitering trip across the mountains to Northwest River and then waiting in fog and rain for clear weather before taking off for Greenland. When the *Jelling,* which had been our home, left, preceding us to Godthaab, we moved to the "hotel," a small frame house on the end of the point (see page 270).

Every morning we walked from here to the dock to reach the plane. The path, running along the water front, took us past whitewashed houses and fenced-in gardens, past fishermen spreading out their nets on the stones, past many huskies and the settlement's one horse, and usually two or three native girls in calico dresses.

The dock itself really started with a boardwalk or porch to the Hudson's Bay post. This long white shack held various activities under its red roof. First, the radio

office, where people gathered for messages and news. Then the Hudson's Bay store, which held everything—cans of food, clothes, blankets, boots, leather and sealskins, real and toy guns, and many other things. The third door was the post office.

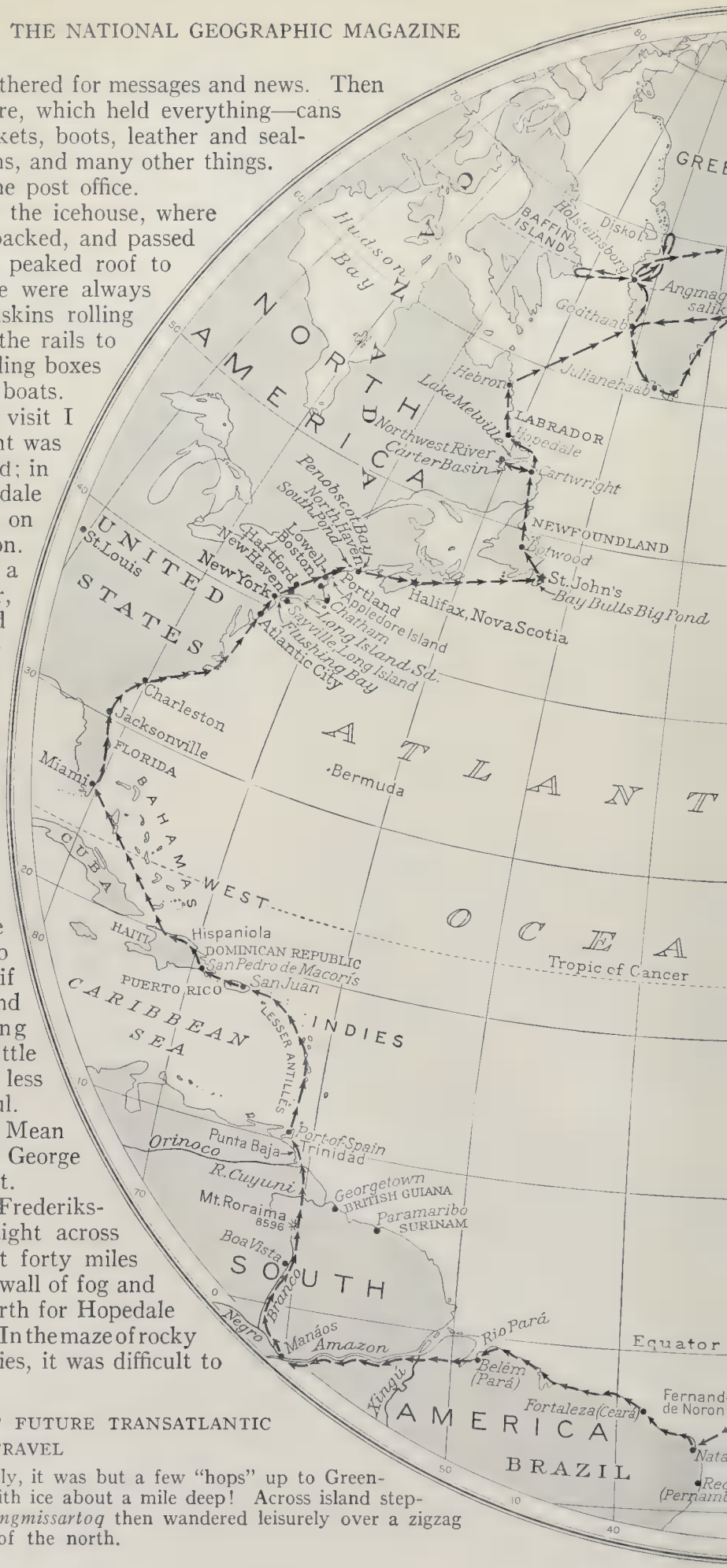
The boardwalk met the icehouse, where fish were salted and packed, and passed through it under the peaked roof to the dock. Here there were always men in boots and oilskins rolling barrels up and down the rails to the icehouse or unloading boxes of fish from the small boats.

By the end of our visit I realized that Cartwright was not the end of the world; in retrospect from Hopedale and Hebron I looked on it as a hub of civilization. One morning, after a week of bad weather, the overcast sky rolled back like a great curtain, exposing the northeast horizon — blue and lovely.

We started out hopefully into the outer harbor only to find there was no wind and we could not get off the water with our heavy load of gasoline. We had more than enough to go to Greenland and return if necessary. Our second attempt the following morning, with a little more wind and a little less gasoline, was successful.

At 14:22 Greenwich Mean Time, July 21, we left George Cartwright's settlement.

We were headed for Frederikshaab, Greenland, straight across the water. But about forty miles out we struck a heavy wall of fog and changed our course north for Hopedale on the Labrador coast. In the maze of rocky islands and promontories, it was difficult to



OVER AIR ROUTES OF FUTURE TRANSATLANTIC TRAVEL

From New York, in July, it was but a few "hops" up to Greenland, its inland covered with ice about a mile deep! Across island stepping stones to Europe, *Tingmissartoq* then wandered leisurely over a zigzag course among the lands of the north.

find the little settlement crouched at the foot of a barren mountain.

There were no trees except a small growth of pines in a ravine behind the houses and there was snow higher up in the crevasses. The little group of red-roofed houses were huddled together, as though from loneliness, around two large white buildings, one of which was the Moravian Mission. The missionary came out and took us ashore.

ESKIMOS AND HOWLING DOGS

A crowd of dark-faced Eskimos and howling dogs met us on the dock. This *must* be the end of the world, I thought. The howl of a husky is a peculiarly lonely sound. But the missionary's two daughters took me up to the Mission House very hospitably while my husband refueled. They had not expected us, as they had no radio operator in the settlement at the time. What was the news of Cartwright? "The *Blue Peter* has left for England," I said. "With its load of salmon? Oh, yes." They explained to me that salmon boats never came up as far as Hopedale. Only occasionally would a ship call for a load of salted cod.

I asked how many people lived in Hopedale. Besides the Eskimos, just their family and the Hudson's Bay family—that was all.

"But who is the doctor?" I inquired, for I saw a dentist's chair in a small room in the mission.

"Why, mother, mostly," the daughter answered. "Mother and father — but

Drawn by Newman Bumstead

CHARLES AND ANNE LINDBERGH LINK TWO HEMISPHERES

Steps became strides south of Rotterdam. Halfway to America and back again; this time to the desert coast of Africa. Eighteen hundred miles of ocean to South America. Lost for a moment over the Amazon. Finally, the United States.

CLIMBING ON THE WING TO PICK UP A MESSAGE

Charles Lindbergh in a southwester, after picking up a weather report from a small boat. The rough water and a strong wind made it difficult for the boat to approach the plane.

Photographs by Charles and Anne Lindbergh

ANNE LINDBERGH AT THE CONTROLS OVER HER HUSBAND'S ANCESTRAL HOME

Usually busy at the radio, she takes the stick while he turns to photography. *Tingmissartoq* was flying between Stockholm and Karlskrona, Sweden, when the picture was taken.

sometimes a dentist comes up here and we use this chair."

But in spite of their isolation they had made a charming and comfortable home in the Mission. I saw a radio and organ in their living room. They had the luxury of fresh eggs from chickens in their yard, fresh vegetables from a garden fenced in from the winds, and even—up among the stunted trees—blue larkspur growing about a summer house.

We went away very much refreshed after coffee and cake given us by the missionary's wife. "Tell them at Hebron that the boat left here several days ago," they said—and we were off.

ASSAILED BY MOSQUITOES

We did not appreciate what "the boat" meant until we arrived in Hebron, after a two-hour flight up the coast, over white sheets of field ice. Very much like Hopedale in its setting, red roofs perched against a snow-patched mountain, it was far more barren and desolate.

The Eskimos who came out on the point to meet us were dark and ragged looking, all wearing hoods, some fur-lined, to protect them from the mosquitoes. For, as the breeze from the engine stopped, we found swarms around our heads. It was impossible to brush them off. We pushed up our collars, pulled our helmets down, and smeared our faces and hands with citronella oil. But it was not until we had climbed up the steep hill, entered the Mission House and shut the door behind us, that we were free of them.

"We are almost starving, literally," said the missionary, as his wife and little daughter hurried about to find something for us to eat. "Our boat has not come in. Have you any word of it?" For they had no radio or regular communication of any kind except this yearly provision boat. We told them it had left Hopedale and that we had passed over it about a hundred miles to the south. They had no flour, no sugar, no vegetables.

My husband went back to the ship to get the sandwiches and one banana saved from the lunch we had been given in Cartwright. It seemed impossible that we could have left such luxury only that morning. Even Hopedale was looked back to as a land of plenty.

"It was different in Hopedale," the missionary's wife said wistfully, as she showed me a single rose in a tin can, the only one of five to survive the freezing winter. "It was not so cold in Hopedale. Here in winter we leave this room uncomfortably warm at night, the stove going full. But in the morning the walls are coated with ice—oh, it is so cold here!"

But this year they were going home on leave. The boat from Hopedale which was bringing the substitute missionary would take them to England. Our arrival with the news of its approach was very encouraging to the missionary and his wife. But not to little five-year-old Joan. She prattled on to me as we drank some much-appreciated tea. She had heard the big noise and thought it was the ship. But it was only a plane and so she had cried. We knew there was nothing we could do to lessen her disappointment. But we gave her the one banana—to show our sympathy.

GREENLAND'S ICY MOUNTAINS

We were three hours out from the coast of Labrador when we first saw them. Behind us lay the wavelike formation of fog on the surface of the water which we had just crossed. The sea was blue ahead and the sky clear and cloudless. And, there they were, "Greenland's Icy Mountains!"

First we could see only their tops, like clouds on the horizon, then a jagged blue line, and finally, as we came nearer, white caps and white-streaked sides stretching as far as one could see. We were flying quite high as we came toward them. Below us glistened a few icebergs like small white sails. But the mountains towered up magnificently to meet us, a great wall against the sky. There were cuts in the wall, too, through which a white glacier gleamed occasionally at the end of a deep fjord.

We began to notice, now, the lower land in front of the mountains. A bare rocky coast, much cut up by fjords and dotted with islands, it did not show any sign of growth or vegetation. Not until we were quite near did we see something that looked like green moss in the steep valleys.

Godthaab was in one of these valleys, facing a half-moon harbor. The tiny settlement in a scoop between rocky hills looked even smaller against the background of distant peaks. After landing outside, we taxied first into the storm harbor behind the town and dropped anchor; then, as the self-starter would not work, we were towed into the

TAKING OFF A MAXIMUM LOAD FROM "GLASS WATER" AT CARTWRIGHT WAS IMPOSSIBLE

With no helping wind or wave, it is difficult to break pontoon suction when a heavily loaded seaplane attempts to "get up on the step." The second attempt the following morning, with a little more wind and a little less gasoline, was successful.

Photographs by Charles and Anne Lindbergh

CARTWRIGHT HAD THE ONLY HOTEL BETWEEN NEWFOUNDLAND AND ICELAND

town harbor by an official Danish welcoming boat.

We were slightly ashamed not to be under our own power as we rounded the point and heard the town cannon welcome us three times. Nevertheless, it was an exciting entry.

ESCORTED BY KAYAKS

Kayaks on all sides kept up with us easily, cutting knifelike through the water with hardly a splash or mark, the narrow two-sided oar going deftly into the water like a needle.

The town as we first came upon it looked like a toy village, with its bright-colored houses just set down by a child playing—a red church with white trims, a green house with yellow shutters, a yellow house with green shutters, and, perched on a cliff, a small bright-red house with a green door, just like an apple.

The dock was jammed with people in gay colors, reds and blues. Coming nearer, we could see the Greenland women all dressed in holiday style—high red boots, sealskin pants, bright blouses, and tall knitted caps.

As we stepped from the boat to the dock they all shouted and followed us up the street to the Governor's house, where the Governor and other members of the colony gave us a hearty Danish welcome. Here we met Commander Dam, the representative of the Danish Government who was to accompany us on the *Jelling,* and who gave us much assistance during our flights in Greenland.

That evening, in the bright golden light, the *Jelling* came in from the fishing bank outside of Godthaab, where it had been stationed, waiting for us. The church steeple was outlined like a pointing finger against one jagged purple mountain; and down on the dock, the Greenland belles were walking up and down in their bright boots.

ESKIMO HUTS WITH WINDOW PANES AND FLOWERS

The next day we had a chance to see the town. It seemed quite large after Hebron, and very prosperous. The square frame houses were well built and freshly painted, some with little fenced-in gardens. A store and warehouse, a church, a hospital, a large school with an equipped gymnasium were a few of the prominent buildings.

The Greenlanders (they are always called Greenlanders here and not Eskimos) that we met as we walked around were prosperous looking. Healthy and gay, they were in their best clothes, for it was Sunday and therefore no one was working. The long kayaks were pulled up on shore and fish were drying on overturned boats. We saw a few of the original style of Eskimo huts, made of turf and stone bricks. But even these had window panes, through which, in one case, I could see a flower growing in a can, a needle and thread, and a cup of coffee.

Next door to this old hut a Greenlander was building a fine frame house. He was allowed to work on his own house on Sunday. Down in one of the green valleys some young Greenlanders were playing football. The boys wore hooded blouses and trousers, but I wondered how they could kick the ball with their soft sealskin boots.

Our walk ended at the red church just as afternoon services were beginning. The Greenlanders were gathering from all sides —running down the hills and strolling up the paths in their gay clothes. The women, in addition to yesterday's costume of boots, pants, and blouses, wore large, many-colored bead collars, strung in geometric design and reaching almost to the waist. The little girls wore dresses just like their mothers'; and the boys and men were in blouses, usually blue, and trousers.

Blue, green, and red mingled together in front of the church until, just at five, four little white doors on the square steeple flew open and a bell began to chime. Then with a sudden flutter of voices, like a flock of startled birds, all the bright crowd swarmed up the steps and into the door. The last two to go in were an old woman, thin and bent but still brave in her red boots, and a little boy on crutches. The doors shut behind them and for a moment there was silence. Then, muted as though at a great distance, voices woven in one firm band of sound—the pure square tones of an old hymn.

We were to hear them sing again the next evening in the gymnasium—the song of the motor boat with the engine chorus "Shoo, shoo, shoo," the whaling song ("The Boat Is Coming In with the Whale"—in Eskimo language, of course), followed by dancing.

I expected to see something quite new in these Greenlander dances and was surprised to have two old men with fiddles sit down and begin a jig. The men and girls lined up for regular old English country dances like "The Hay," "Gathering Peasecods," and "Paul Jones," all taught them, I was told,

AT HEBRON EVEN THE ESKIMOS WORE HOODS TO PROTECT THEM FROM MOSQUITOES

The insects swarmed around the heads of the Colonel and his wife when he cut the motor, thus shutting off a gale from the propeller. Natives, watching them from the dock, are wearing parkas to protect them from bites.

Photographs by Charles and Anne Lindbergh

AT THIS ISOLATED MISSION LITTLE JOAN WAS DISAPPOINTED AT SEEING AN AIRPLANE

She cried because the buzzing noise she heard in Hebron's harbor was only an airplane's motor—not the yearly boat which would bring fresh food. The Lindberghs comforted her with a few sandwiches—and one banana—left in their plane, which they had brought from more accessible Cartwright (see text, page 269).

Photograph by Charles and Anne Lindbergh

IN GAY ATTIRE GREENLANDERS TURN OUT FOR CHURCH

Anne Lindbergh and Commander Dam (center); Major Logan, Dr. Duffield, and Mr. Jarbo of the Pan American Airways Expedition (right); meet some Greenlanders in Sunday dress at Godthaab. Greenland women usually wore high, bright boots, sealskin pants, gay blouses, and many-colored bead collars.

by early Scottish whalers and traders. The dances had a different flavor to them here in the north, gayer and rowdier as though done by children, perhaps because of the red boots of the women or the stamping and clogging of the men or a quickened time.

And, as always, the side play: the old man who clogged so hard, just a little harder than anyone else, his body bent over in the exertion, and kicked a little higher with more dash so that the crowd all shouted with delight. (One of those wonderful people alike in every race who know how to add the flourish to life.)

Then, the young blades after each dance finished, coming up to the fiddlers and asking them (so I guessed), "Do you know—tum te tum tum tum? It goes like this" (hands and feet all going). The fiddlers trying it, the tune petering out feebly.

The man with the accordion starting to play. Someone coming in with candles, which were set in the high windows. The dance which started out beautifully and ended in a chatter of confusion, explanation and laughter. The galloping Virginia reel which ended in a man chasing a girl in and out of the lines—the girl's hair falling down—and someone's bead collar ripping.

Then suddenly it all stopped and, quiet and shy, they streamed out into the cold mist and strolled down the hill arm in arm. The women, I was told, must go to bed early, for they have work to do in the morning, hauling coal and working on the roads and docks. The men will not do anything like that. Their traditional job is hunting and fishing, and manual labor at home is beneath them.

THROUGH FOG TO HOLSTEINSBORG

It was true, the next morning as we left the storm harbor, that all the women in working clothes, short skirts and sweaters, were unloading a schooner by the warehouse. When the *Jelling,* which was also setting out, blew her whistle, they all dropped their loads and ran shouting to the top of the hill to see her off. There they stood waving as we took off a few minutes later for Holsteinsborg.

There was fog over Godthaab as we left—a low thick fog on the sea, extending to the first barrier of rocky islands. Here it

Photograph by Charles and Anne Lindbergh

AGAINST THE BACKGROUND OF DISTANT PEAKS "TINGMISSARTOQ" RIDES IN THE STORM HARBOR OF GODTHAAB

This was the Lindberghs' first stop in Greenland. Here, in 1888, the Norwegian explorer, Fridtjof Nansen, completed the first crossing of the ice cap. The base ship, *Jelling,* lies at anchor across the harbor from a Danish warehouse.

Photograph by Charles and Anne Lindbergh

PARTS OF NEW ENGLAND MAY HAVE LOOKED LIKE THIS SOME TENS OF THOUSANDS OF YEARS AGO

Greenland's inland ice cap here extends a broad glacial tongue, crevassed and dirty, toward the sea between Godthaab and Holsteinsborg (see map, page 262). Melting, the ice forms a lake, bottled in by low hills, and a cascading stream carries off the overflow to an ocean fjord.

Photograph by Charles and Anne Lindbergh

"THE MOST BEAUTIFUL WINDOW IN GREENLAND"

Governor Rasmussen's guests spent many evenings at his window in Holsteinsborg, "watching the fog curl over the mountains; or the little boats in the harbor, trailing their ripples in the satin water; . . . or the huskies snapping at flies in the dusk; or a Greenland mother, with her baby on her back, balancing back and forth from one foot to another to put him to sleep."

seemed to pile up and break, like foam on a shoal, leaving the country inland clear and cloudless.

Following a fjord up to the ice cap, we flew north, skirting its edge; across ice-filled fjords and their long mountains; across tongues of glacier; for a time even, across part of the ice cap itself—until we reached Hobbs' base.

After circling his camp—a few huts on a fjord near the foot of the ice cap—we headed out to the coast. Seeing a small group of houses at the mouth of a fjord, we landed about four hours after leaving Godthaab. This must be Holsteinsborg, we thought. There are so few settlements one can hardly make a mistake. Some Greenlanders came out in boats to meet us.

"Holsteinsborg?" we shouted. "Holsteinsborg?"

They shook their heads and pointed northwest. We had landed southeast of the town. This settlement was several hours' boat ride away. As we started to pull up anchor again, a Greenlander in the nearest boat took a pad and pencil out of his pocket, wrote a note and handed it to my husband. "Holsteinsborg," he said smiling and pointing. It was, we discovered, a note for the Governor of Holsteinsborg.

I do not know whether the Greenlander had ever seen a plane before, but certainly he took it as a matter of course, and was quick to avail himself of the advantage of airmail. He might have done even more had we not left immediately. The next day a goose came by boat to the Governor of Holsteinsborg from the same Greenlander, with a note, "It is too bad I did not think to send the goose by the flyer."

Photograph by Charles and Anne Lindbergh

TO THEM THE LINDBERGHS WERE MERELY THE ONES WHO FLY LIKE A BIG BIRD

A cluster of curious faces gathers outside the window in the guesthouse of Mr. Rasmussen, Governor of Holsteinsborg, where the aërial explorers stayed. Extremely fond of children, Greenlanders rarely punish their sons and daughters. In the background is the blue schoolhouse.

The harbor of Holsteinsborg was shielded on the north by a long bare mountain. The little town, growing up a green slope, had, like Godthaab, a distant peak for its background. The slope itself was much steeper. The little houses, perched on the sides of the hill and halfway up the cliffs, looked like mountain goats; the church, sitting erect on top, like a watch dog guarding its flock. The houses, too, were bright-colored as in Godthaab, the red church, the blue schoolhouse, the yellow house of the minister, the red store.

We came to know them very well during our week in Holsteinsborg. They all faced the little village "square"—or circle, it was really—on the crest of the hill. Here the paths around the flagpole were worn dusty with many feet passing all day long; children on their way to school, mothers carrying their paper bags full of sugar, raisins, and coffee (all in one bag) from the store, people on their way to the hospital or the church or the bakery or the Governor's office.

They all passed under the gate or arch of two enormous whale bones which marked the entrance to the "square." And they all passed under Mr. Rasmussen's window.

Mr. A. A. C. Rasmussen, the Governor of Holsteinsborg, was about to leave on his vacation. But he and his wife took us into their home with the most wonderful hospitality. They sent us out and welcomed us back on our various reconnoitering trips up the coast and to Baffin Island, never ceasing to marvel at the speed of air travel—"You have been all the way to Ritenbenk!—to Ritenbenk and back to-day!" Or, after our four-hour trip to Baffin Island, "Welcome back from America!"

A FRESH-WATER EXPEDITION FROM THE "JELLING"

Left to right, Dr. Duffield, Major Logan, and Anne Lindbergh climbing along the side of a rocky hill near Holsteinsborg, in search of a mountain stream.

Photographs by Charles and Anne Lindbergh

SAFELY BACK FROM A KAYAK RIDE AT HOLSTEINSBORG

This narrow craft is difficult for the beginner to balance. The double-bladed paddle laid across the deck in outrigger fashion steadies the kayak. When a Greenlander hunts seal in choppy waters, he keeps himself and his kayak dry by lashing under his armpits an apron secured to the manhole ring.

We spent many evenings at Mr. Rasmussen's window, watching the fog curl over the mountains; or the little boats in the harbor, trailing their ripples in the satin water; or the Greenlanders padding up the hill; or the huskies snapping at flies in the dust; or a Greenland mother with her baby on her back, balancing back and forth from one foot to another to put him to sleep, "Ajungilak, Ajungilak" (Be good, be good).

For it was as they said, "The most beautiful window in Greenland" (see page 276).

Photograph by Charles and Anne Lindbergh

REFUELING AT BOTWOOD, NEWFOUNDLAND

Seated on the engine cowling, Charles Lindbergh holds the nozzle of the refueling hose. At low cruising speed the Lockheed Sirius consumed 25 gallons of gasoline per hour while covering 118 miles.

ACROSS THE ICE CAP

One morning we passed under Mr. Rasmussen's window for the last time. We were leaving Holsteinsborg. All the Greenlanders were there to see us off. I do not know how they knew we were going, for our plans were full of sudden changes. But they always knew. They were always the first to see the plane returning from a trip. Long before anyone else could hear the hum of an engine, all the dogs and children would run out onto the point and the sharp cry of recognition would be picked up by one person after another, "Ting-miss-ar-toq—Ting-miss-ar-toq!" (The one who flies like a big bird.)

They were all there to see us pass under the whale-bone gate with our bundles and also with sandwiches and cookies from Mrs. Rasmussen's blue kitchen, several cans of halibut from Mr. Rasmussen's canning factory, and warm dogskin-lined *kamiks* (sealskin boots) made for us by an old Greenland woman. I saw her there in the group as we waved good-by. "Goo'by," answered some of the Greenlanders. "Hullo," said others; still more, the Danish "Farvel," and, last of all, "Inudluarna" (the Greenlanders' good-bye, or, more accurately, "May nothing go wrong with you").

We left Holsteinsborg at 14:42 Greenwich Mean Time, August 4, for the east coast, a trip which would have taken one of our Danish friends over a year, unless he chartered a ship. They could sail on the next boat from the west coast back to Denmark, but then (for it would be too late in the summer for a boat to reach the frozen east coast), they would have to wait until the next year to take the boat back to Scoresby Sound or Angmagssalik.

Photograph by Charles and Anne Lindbergh

BUSY DAYS AHEAD FOR THE INTERNATIONAL ICE PATROL!

With a sinister roar heard miles away, icebergs calve from the glacier-choked mouth of a fjord in Disko Bay. Weeks later these same bergs may drift across North Atlantic steamship lanes.

We planned on going straight across the ice cap, but first followed the coast north to gain altitude. Rocky islands and steep-walled fjords passed under us and one glacier coming down to the sea, where great blocks of ice were breaking off and floating away—new-born icebergs. An hour later Disko Bay spread blue far below us and we turned east.

"Posn (position) at 16:00," I radioed back to the *Jelling*. "Over Christianshaab at 5,400 feet—taking 69° course."

LAKES LOOK LIKE TINY POOLS

We were approaching the ice cap now, climbing slowly upward. That smooth white dome seen beyond the rim of mountains was so unreal that I had nothing in my mind to compare to it. It hardly looked like snow. When we were actually over the ice cap, it did look like snow, but dirty and streaked as though raked by snow plows. The long, crooked lines were melted streams running down into fjords, the longitudinal wrinkles were crevasses.

We very quickly passed this crevassed area and were flying over clean white snow and occasional ice-blue pools. They must have been lakes, but, as we were flying high and there was no object of comparison to give any idea of size, they looked like small pools to me.

"Posn 16:55—about 70 miles inland on ice cap."

The mountains behind us on the coast were sinking fast below that white dome. Still black on the horizon, soon they would be submerged from our sight. Ahead—nothing but dazzling white, a white that had no depth or solidity but looked like clouds or fog under a glaring sun.

"Posn 17:48—On 69° true course, speed 100 knots."

We were flying by dead reckoning now. There were no landmarks. Everything looked the same below us, and even above us, for the sky was overcast. With no horizon distinguishable, the whole world looked like a gigantic white bowl. My husband pushed back his hatch and put on a pair of amber glasses with which he could see through the haze and glare to wind ridges in the snow below. It began to be rather cold, although the temperature was never lower than 13 below centigrade, and this at an altitude of 13,000 feet.

Photograph by Charles and Anne Lindbergh

THE ENGINE'S COWLING UNDERGOES REPAIRS ABOARD THE "JELLING"

Mr. Homan takes advantage of the bad flying weather to weld a crack. In the interested audience, left to right, are Captain Hogestadt, Dr. Duffield, and the *Jelling's* engineer.

I was wearing, in addition to woolen underwear, one thin wool shirt, one thick wool shirt, one wool sweater, wool riding trousers, several pairs of wool stockings, fur-lined kamiks and helmet, and over everything the hooded white blanket parka designed for us by Dr. Stefansson. I was quite warm except for my feet, which I sat on, and my hands, on which I put another pair of mittens. A third pair would have been very comfortable, but would have made my fingers too bulky to handle the radio key.

"Posn 19:10—course 78° true—direct line Christianshaab to Scoresby Sound—Speed 100 knots—altitude 11,500."

We were now about halfway across. My husband handed me back a note: "Every five minutes we save a day's walk!" That was encouraging. Also we began to hear the Danish ships on the east coast. Wonderful feeling—while still in contact with the *Jelling* behind us, to be able to reach out to a helping hand ahead.

"Posn 19:45—250 miles on 258° true course from Amdrups Havn in Scoresby Sound."

We were really approaching the other side and began to send messages asking where the Danish planes were stationed on the east coast. Dr. Lauge Koch, the Danish explorer, had an expedition which was carrying out an aërial survey of the northeast coast (see illustration, page 284).

"20:05—mountains visible on east coast."

They were still only dark shadows on the horizon, a relief to the eye after the dazzling white of the ice cap, when Dr. Koch's base ship answered us. They advised us to go to Ella Island, where one of their planes was anchored. "Good weather, no ice, always calm"—it sounded like a safe and restful haven.

"Changing course to Ella Island," we replied. Being assured by radio of a safe anchorage while one is still over icy wastes is a miracle to which there is no parallel. The comfort of it is rather like walking through a dark room, always keeping one's eyes on that light beyond in the hall.

Now the mountains were quite visible, sticking their heads up out of the white crust. I had the illusion that the snow had just fallen, it was so clean and fresh, and that it was deeper than on the west coast.

Photograph by Charles and Anne Lindbergh

WIRELESS ACROSS THE ICE CAP INVITED THE AVIATORS HERE

Hearing by radio that there was a safe anchorage at Dr. Koch's base at Ella Island, the Lindberghs landed here after crossing the Greenland ice cap from Holsteinsborg. This picture was taken from the plane by midnight sun.

Here the snow-covered mountains came down much nearer to the sea. Soon after we reached them we saw the head of a fjord. I sent my last message to the *Jelling* on the east coast.

Over the ice cap it went, "Posn 21:00—over head of Nordvestfjord north of Renland—landing in 30 minutes."

Over the ice cap came back the "dit darr dit—dit darr dit—dit darr dit—(Received OK). They had followed us all the way across for seven hours. Ella Island was below us in the hard crystal light of a northern evening, its high cliffs rising up sheer from the water, frozen into the sky. At their feet, a low beach on which we could see Dr. Koch's camp and the brave red Danish flag (see "Flags of the World," page 385).

"Landed Ella Island 22:00 G.M.T."

Eskimonaes, on Clavering Island, Dr. Koch's second base, was the northernmost point we touched, about 74°. With its great mountains and fjords, its cliffs and glaciers, its lack of human habitation, and—always behind, just out of sight—that mammoth ice cap, it seemed like a land hewn by giants. I felt that it was not made for us, but for another people and another age—as indeed it was. The herds of musk ox we saw testified to that. For the musk ox, although to me rather like a buffalo, is, I am told, an almost extinct animal of the ice age.

On August 6 we started south from Clavering Island, flying just inside the coast line between ice pack on one side and glaciers on the other. At one point along the route, seeing a range of mountains where none was charted on the map, we turned inland for fifty miles, following an ice-filled fjord which extended beyond its location on the map, almost connecting with a branch of the long fjord of Scoresby Sound south of Gaaseland.

This fjord led us nearly up to the mountains. Turning south, we found another higher mountain range which extended far inland, although the map showed the ice cap coming down almost to the coast. Flying a hundred meters to the side of the highest peak, we found it to be approximately 12,300 feet above sea level.

Amdrups Havn, in Scoresby Sound, was the only settlement we passed, circling over its ice-filled harbor on our way to Angmags-

Photograph by Charles and Anne Lindbergh

A DANISH SURVEY PLANE CONVOYS THE FLYERS TOWARD THEIR FARTHEST NORTH

Dr. Lauge Koch, in a hydroplane, guides the explorers over broken field ice to his base on isolated Clavering Island, Greenland. They saw numerous herds of the musk ox, and one polar bear. During the summer season, grass and flowers grow in this mountainous region north of the Arctic Circle.

salik, which we reached in the late afternoon. The harbor at Angmagssalik was so full of icebergs that the *Jelling* could not have come into it without striking them; but the plane managed to thread a landing between them and taxied slowly into the tiny inner harbor (see pages 291 and 296).

Angmagssalik was the only settlement we visited in east Greenland. It seemed a little like the other coast—but intensified. There was the same background of mountain peaks, but the peaks were sharper, blacker, and more snow-streaked. There was the same setting of bright houses up a steep hill. But the hill was steeper and the houses were brighter—all red.

The Eskimos themselves were more Eskimo, dark and slant-eyed, all wearing native costume, many of the women with their hair drawn into a tight topknot, old-fashioned Eskimo style. There were more turf houses than we had seen before and, as we came into the harbor, there were more howling dogs. It was more isolated, more primitive, more beautiful—well, it was *more*.

We visited one other colony in Greenland, Julianehaab, on the west coast. A day or two after landing in Angmagssalik, we flew back across the ice cap to Godthaab and down the coast to Julianehaab. This southernmost and largest colony was perhaps the most prosperous and attractive. It was evening when we arrived. We were now hundreds of miles south of the midnight sun. There were lights on in the town, a fountain going in the little square.

GREENLAND'S "GAY" METROPOLIS

The *Disko,* the official boat from Denmark, was just pulling into the harbor on one of its three trips to Greenland. On the white bridge the Greenlanders were dancing. Across the water I could hear them singing, "The Boat Is Coming In with the Whale" (see page 298).

Godthaab was the first colony we saw and it created our impression of Greenland. Holsteinsborg was our favorite, for we were there the longest time. Julianehaab seemed the gayest. But Angmagssalik was our last port, after cutting across Cape Farvel from

Photograph by Charles and Anne Lindbergh

BLOOD OF THE VIKINGS FLOWS IN THEIR VEINS

Colonel Lindbergh, whose paternal ancestors were Swedes, faces the sun with his host, Dr. Lauge Koch, a Danish authority on the geology of Greenland, and a member of the latter's expedition (see text, page 281). Clavering Island was the most northerly point reached on the flight.

Julianehaab. And it was Angmagssalik that remains in my mind—prickly, flame-like mountains across the fjord, red houses climbing up a green gully, patches of bluebells halfway up the hill, bright boots hung up to dry in the sun, and Greenlanders, in the evening light, twirling round and round on a dusty path to the whine of an accordion.

It was at Angmagssalik we were fortunate enough to meet the late Dr. Knud Rasmussen, the famous explorer, and his mapping and surveying party. It may have been their interpretation of Greenland that unconsciously influenced us. Dr. Rasmussen has interpreted Greenland to many people through his books, and wherever he was and among the people who worked with him, there was a remarkable enthusiasm and spirit. They would rather be in Greenland working with Knud Rasmussen than anywhere else in the world.

And it was at Angmagssalik, finally, that our plane was christened. Sitting on the wing when it was at anchor, a young Greenland boy painted on its side *"Ting-miss-artoq,"* the name the Greenlanders had given it. He put the lettering parallel to the water and not to the lines of the plane, but we would not have it changed for anything; it was done at Angmagssalik (page 294).

BACK TO CIVILIZATION—IN ICELAND

On August 15, at 15:27 Greenwich Mean Time, we left Greenland for Iceland, detouring up the coast to fly over Lake Fjord, that deep trough in the mountains where the British Watkins expedition was stationed (see page 300). After about three hours over water we were in sight of Iceland and landed near Reykjavik at 20:44 G.M.T.

The contrast between Greenland and Iceland was far more than our slight five-hour trip seemed to warrant. This high and mountainous land looked as if all the tops of the mountains had been leveled off evenly with a trowel. Great bluffs dropped down steeply to a rolling coast, which was very green and dotted occasionally with little farms. Reykjavik, spread out below us, looked enormous. Rows of modern houses, good roads, cement and corrugated iron buildings, automobiles, docks lined with boats—all showed that we were back in civilization.

I left Greenland with the impression that it was the country, gigantic and untamed, which dominated life, and that man was only a minor character who had adapted himself to the rigors of this life; I left Iceland feeling that here, in this people, were the giants who conquered the land. They had cultivated the thin-soiled, stony fields, raised cattle on the volcanic slopes, and had even, in some places, harnessed Nature's hot springs to heat their buildings and greenhouses. A parliament was held by them in the plain of Thingvellir, 930 A. D. Certainly they had established a remarkable civilization in a beautiful but rather forbidding land.*

We had a chance to see more of it on our departing flight around Iceland: the white-topped volcanoes with their hardened streams of lava blackening a valley below; the stony fields; the rough coasts; and the steep fjords, which cut into the heart of the country. In one of these fjords on the east coast we landed and spent the night in the fishing village of Eskifjördur (304).

On August 23 we left Iceland for the Faeroes.† These beautiful rocky islands are famous for their bad weather. We came upon them in what we thought must be a typical day. They were wreathed in mist, and the long open fjord which we followed from the west side of the islands to the east was like a tunnel through the fog. We could never see the tops of the walls which formed it (see illustration, page 308).

When we finally reached the east side and made our way through patches of bad weather to the southernmost island, we found the entrance to the Tverå Fjord almost blocked off (see page 306). The fog was right down on the water. Could we get in? Circling around, we managed to squeeze under a 200-foot ceiling, and landed in a light drizzle below the banks of Tverå.

I breathed a sigh of relief and thought we were lucky to get through. Our Faeroese host thought we were lucky, too—but for other reasons. As we climbed the hill in the rain, he remarked, "Good weather *now;* it's lucky you didn't come this morning."

We never saw any real Faeroese weather, for we left the next day with beautiful clear skies which lasted to the Shetland Islands. Here in Lerwick (page 301) we had one day of bad weather which we were happy to spend in that charming gray-roofed, gray-walled town before continuing on our way to Copenhagen (Köbenhavn).

* See in the National Geographic Magazine, April, 1928, "The Island of the Sagas," by Earl Hanson, and "A Walking Tour Across Iceland," by Isobel Wylie Hutchison.

† See "Viking Life in the Storm-Cursed Faeroes," by Leo Hansen, in the National Geographic Magazine for November, 1930.

ALONG NORWAY'S COAST AND OVER DENMARK'S FIELDS

On August 26 we flew over the North Sea, past the coast of Norway and over the flat green fields of peaceful Denmark. After a five-hour flight, we landed in the harbor of Copenhagen,* among hundreds of little boats that looked from the air like myriads of white butterflies and gnats on a summer's pool (see page 309).

Tingmissartoq had a 9-day holiday in Copenhagen, as we did, and was beautifully cared for by the Air Force of the Danish Navy. It was quite ready to start again on September 3 for a flight to Sweden—over the square fields of Skåne† patterned below us, shadows of windmills moving black across them; red-roofed towns and their church spires pricking out of trees; forests and lakes; the coast, cut up into pine-covered islands; and finally, Stockholm—spires and ships and towers and bridges and pine trees, all set down in sparkling water (see illustrations, pages 310, 311, and 312).

After another holiday in the waters of Sweden, ending with a flight to Karlskrona, *Tingmissartoq* left for Helsingfors (Helsinki) on September 20. Our route from Karlskrona lay over the long island of Öland, where Nils and the geese once spent the night; and Gotland, where the walled town of Visby stands ringed with fortresses facing the sea, just as it always has since the days of the Hanseatic League. Then, straight over the Baltic to Finland, with its thousand pine-covered islands and, set down among them, Helsingfors, its modern capital.

TOWERS AND BRIDGES OF LENINGRAD

From there, it was a very short flight up the Gulf of Finland to Leningrad. In less than two hours we met the welcoming Soviet planes. The mosque on the island of Kronstadt was below us and ahead we could see the towers of Leningrad with the gold dome

* See "Royal Copenhagen," by J. R. Hildebrand, in the National Geographic Magazine for February, 1932.

† See "Country-House Life in Sweden," by Amelie Posse-Brázdová, in the National Geographic Magazine, July, 1934.

Photograph by Charles and Anne Lindbergh

HOLSTEINSBORG IS A TINY HANDFUL OF HOUSES, LIKE A SCATTERING OF PEBBLES, AGAINST GIANT MOUNTAINS

The little colony of bright-red, green, and blue houses climbs a rocky hill. The *Jelling,* Pan American Airways Expedition ship, looks like a toy boat in the outer harbor. This picture was taken from an altitude of about 4,000 feet.

Photograph by Charles and Anne Lindbergh

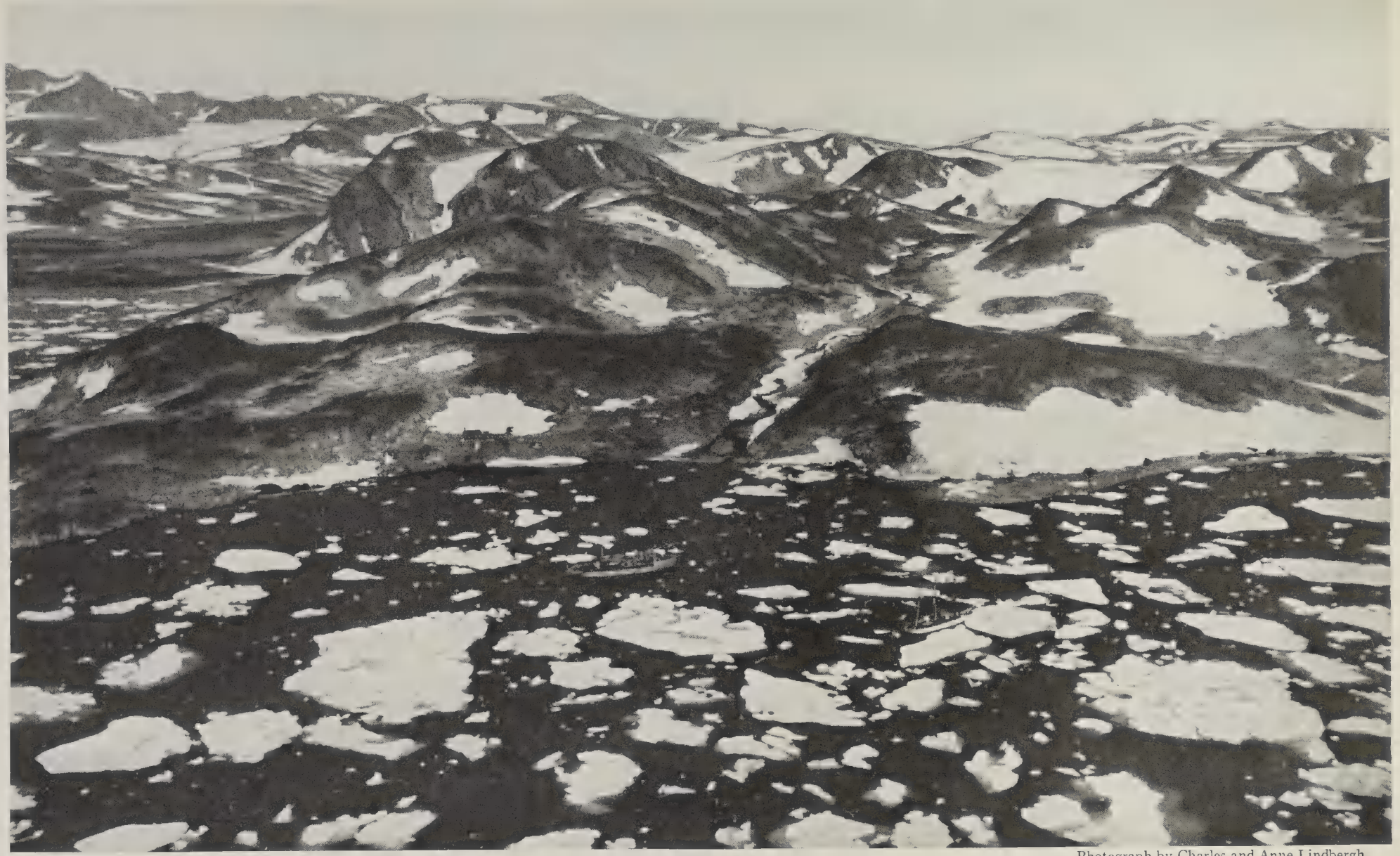
BLACK MOUNTAINS PUSH JAGGED POINTS THROUGH SNOW AND ICE

A tip of the wing shows in the picture as the plane skirts the ice cap southward from Clavering Island to Angmagssalik.

Photograph by Charles and Anne Lindbergh

A SETTLEMENT IS ONLY A FEW MINUTES AWAY, BY AIR: IT WOULD BE WEEKS, BY LAND

Here loose snow and rock have gathered, packed into ice, and formed a U-shaped glacier, gradually receding from the coast, north of Scoresby Sound. Amdrup's Havn is less than a hundred miles to the south.



Photograph by Charles and Anne Lindbergh

TWO FRENCH BOATS AMID SHIFTING ICE OFF THE LITTLE TOWN IN SCORESBY SOUND

Submerged portions of bergs may be seen distinctly in the crystal-clear waters of the harbor, where the sea penetrates far into Greenland. A steep-walled amphitheater was hollowed by a grinding glacier from the rocky hill above the village.

Photograph by Charles and Anne Lindbergh

FROM THE AIR THIS BROAD GLACIER SEEMS LIKE STREAKED MARBLE BETWEEN BLEAK MOUNTAINS

The white is ice and snow, while the black bands are rock fragments and dirt scraped from the base of mountains and carried along for miles on the back of the glacier. Huge chunks, gnawed by the sea from its edge, appear as tiny white sails on the waters of this fjord, south of Scoresby Sound.

Photograph by Charles and Anne Lindbergh

THE PLANE THREADED A LANDING BETWEEN ICEBERGS AT ANGMAGSSALIK

Then it taxied into the inner harbor below the steep hills of the town. One of Dr. Knud Rasmussen's expedition ships lies just inside the harbor entrance.

FOG VEILS THE MOUNTAINS NORTH OF KANGERDLUGSSUAK

Photographs by Charles and Anne Lindbergh

OVER TWO MILES HIGH AND UNCHARTED!

As the Lindberghs flew close to the top of the highest peak in this snow-strewn range, the altimeter indicated 12,300 feet.

of St. Isaac's Cathedral (now a museum) glinting in the sunshine.

We were in Russia one week, including two days of flying, and we accomplished, I am sure, a month of sight-seeing. From our quiet landing in Leningrad, where the plane was quickly and efficiently moored, to our departure from the Moscow (Moskva) River, everything possible was done for us and perfectly arranged by The Intourist Association. After our rather full program, however, my mind was crowded with pictures and impressions.

Leningrad—its wide boulevards, its towers and palaces and parks, its long vistas, its river, crossed and recrossed by lovely low bridges—had, on first sight, the air of a magnificent capital. But, on second sight, one had the indefinable sense of a beautiful city gone a trifle shoddy: the paint coming off the buildings; the stones crumbling in places; the streets untidy with debris, as though a great flood had swept over the city and no one had bothered to clean up afterward.

The crowds of people on the streets, all dressed in shabby clothes, all looking the same, all going in the same direction. The color and gayety and dazzle of an exquisite ballet, performed in a begilded and ornamented opera house and applauded by an audience all dressed in black clothes. The art treasures of the Tsars. Palaces more gorgeous and extravagant than fairy tales. Lenin's picture everywhere. His bare rooms in the old convent. Many modern buildings going up outside of the city itself; factories, apartments, Halls of Culture. A fireman's formation in the big square in front of the pink Winter Palace—red flags and an enormous picture of Lenin hung from the top of a building and reaching to the ground.

But perhaps the most vivid picture is our arrival in Moscow. The flight from Leningrad, over wooded and farm country, reminded one of parts of our Middle West with its sense of space and fertility. At the end of three hours we were met by Soviet flyers outside of Moscow and saw the river circling ahead of us.

Moscow from the air is a wonderful sight, an amazing combination of old and new. It looked enormous, spread out beneath us

Photograph by Charles and Anne Lindbergh

DODGING ICEBERGS REQUIRED SKILL AT ANGMAGSSALIK

High winds and shifting ice made landing and taking off difficult. Even small chunks of floating ice might easily tear the thin skin of the pontoons.

and sprouting with new construction on all sides, so that I felt it was growing under my eyes. In the center, not overawed by the arrogant new buildings, was the old red-walled Kremlin, holding in the circle of its arms fantastic fairy-tale domes.

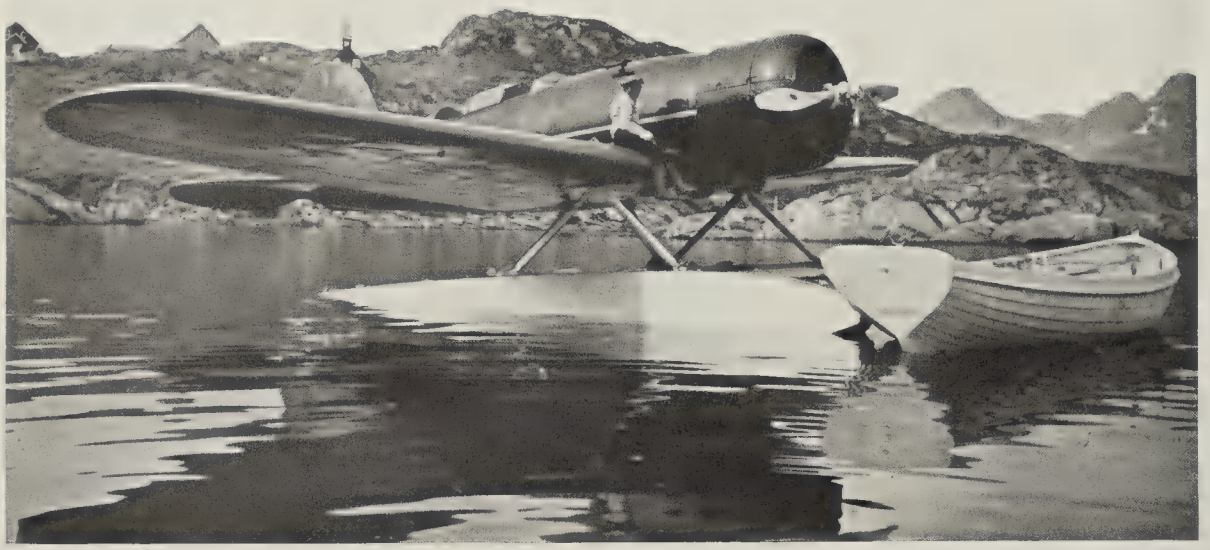
LANDING BETWEEN BRIDGES AT MOSCOW

The river was quite narrow and wound through the heart of the city. We were to land in a rather short stretch of water between two bridges. There was a grandstand packed with people on one side of the river and a public park on the other. I wondered if we could "make it"; and just what would happen if we didn't. After circling low over the river several times, we skimmed over the top of the first bridge, side-slipped steeply down to the water, straightened out, and landed with plenty of room ahead. As we turned back to the dock I was conscious of the roar of cheers from the grandstand—an enthusiastic welcome to Moscow (see page 314).

The enthusiasm of this welcome created an impression which remained in our minds throughout our short visit. There was perceptible, even to superficial sight-seers, a spirit and driving force in Moscow that we had not felt in Leningrad. For in spite of the new construction going on there, Leningrad seemed a city whose glories were in the past, now living in a state of nostalgic old age. While Moscow, in spite of its somber sides, had an unmistakable air of youth.

There were still those drab crowds, those long lines in front of the stores, the uncompleted disorderly look to much of the work (although an amazing amount finished); but there certainly was activity, feverish activity and tireless energy everywhere one looked. The faces of the people, though not exactly happy, were certainly interested—intent on their work in the streets, in the factories, and on the air field. The theaters and museums were always crowded.

The interest in the works of art seemed to be social rather than esthetic: "See the rich robes in this picture! In those days the poor peasant—." But the interest was there and very real. I found myself enthusiastic about the work that was being done for mothers and children; my husband was impressed by the work being done in aviation. Perhaps it was in this latter field that we were particularly conscious of the enthu-



Photograph by Charles and Anne Lindbergh

"TINGMISSARTOQ!" ESKIMOS SHOUTED WHEN THE MONOPLANE CIRCLED OVERHEAD

So *Tingmissartoq* it became—"The one who flies like a big bird." The long word, painted on the fuselage by this Angmagssalik boy, was not changed by the aviators, although it paralleled the water rather than the graceful lines of the monoplane (see text, page 284).

siasm. Not only were the aviation people keen and forward-looking, but there seemed to be a great general interest in planes. There were always crowds on the bridge above the river looking down on our ship anchored below (see page 313).

On September 29 we took our last look at the Red Square; the beautiful wall of the Kremlin, a red tower at each end and its gold domes beyond; at St. Basil's Cathedral (now a museum), with its jeweled bubbles looking as though they had just risen from a magician's wand; and Lenin's small tomb, impressive in its stern simplicity, at the foot of all this splendor. We dipped our wings in salute over Moscow and flew west.

THE "MYSTERY TRIP" TO WALES

We arrived at Tallinn, the capital of Estonia, in the middle of the afternoon and after a day in the walls of that charming medieval town, went on across the Gulf of Finland, over Sweden to Norway. Oslo, set down among islands and pine trees, was lit by the turning leaves of autumn, reminding us that we must finish the northern part of our surveying and turn south.

On October 3 we left Oslo for a flight across to Bergen and down the beautiful coast of Norway, stopping a night at Stavanger. On October 4 we arrived in Southampton. Leaving our plane under the excellent care of the Supermarine plant, we proceeded on what the newspapers called a "mystery trip," to visit my sister in Wales.

October 23 to November 15 was spent in flights about Europe. The log mounts up hours swiftly:

"October 23rd—Took off Southampton 11:26 Greenwich Mean Time, landed Galway, Ireland (after flying up the coast from Valencia) 16:45 G.M.T. October 25th—Took off Galway 11:23 G.M.T., landed at Inverness (where we did not see the 'Big Beastie of Loch Ness') 15:21 G.M.T. October 26th—Took off Inverness 13:12 G.M.T., landed Les Mureaux 17:23 G.M.T. (Thanks to the splendid arrangement of the French Air Ministry, we were able to land quietly at the Naval Base on the Seine near Paris.) November 2nd—Took off Les Mureaux 12:16 G.M.T., landed Amsterdam 14:49 G.M.T. November 7th—Took off

Photograph by Charles and Anne Lindbergh

BOOTS ARE A LARGE PART OF THE FAMILY WASH IN GREENLAND

The ventilation system of Eskimo *kamiks* (sealskin boots) is so poor that the same pair may not be worn with comfort for more than a few days at a time. When dried, these brightly colored boots at Angmagssalik will be scraped until they are soft again.

Amsterdam 11:29 G.M.T., landed Rotterdam 15:55 G.M.T."

This entry in the log usually raises the comment, "But they're less than 40 miles apart! That shouldn't take more than twenty minutes. What were you doing all that time?" The answer is that we were trying to reach Geneva (Genève) through what I considered very thick fog, but which my husband said "wasn't bad at all." Perhaps it wasn't bad. I only know that we spent a good deal of time circling small ponds under the mist. I thought we were about to make a forced landing, but my husband said he was looking at castles. I was all ready to step out in Geneva, and we turned up in Rotterdam! But it didn't matter. I was very glad to see Rotterdam even if it was a five-hour trip from Amsterdam.

"November 8th—Took off Rotterdam 11:38 G.M.T., landed Geneva 14:50 G.M.T. November 11th—Took off Geneva 11:05 G.M.T., landed Santoña, Spain, 16:14."

The weather through Europe was, on the whole, rather bad—fog, rain, storms, and, on the day we left Geneva, snow. I longed for the clear, sharp days of Greenland. When we reached Spain we looked for sunshine. But there were local storms all down the coast and, at Santoña, where we were forced down by blinding rain, *Tingmissartoq* came very near to being seriously damaged.

The wind rose to a gale that night and the plane, dragging two anchors, started drifting down the harbor. It just missed a corner of the stone breakwater before it was rescued with the assistance and skill of the Santoña fishermen and moored with additional lines.

"CUTTING CORNERS" ACROSS SPAIN

After a day in Santoña we started out again, hoping that the worst of the storm had passed. But we were to catch up with it. "Storm at Vigo!" shouted someone just before we took off. "You must not go!"

"Oh, we'll go and see what it looks like!" shouted back my husband.

Not content to see "what it looked like" from the coast, he decided to make the trip shorter by cutting across the corner of Spain to Portugal. Squeezing between low clouds and the peaks, we crossed one range of mountains and a high, bare plateau.

Photograph by Charles and Anne Lindbergh

HERE THE ESKIMOS CLING TO THE COILED HEADDRESS OF FORMER DAYS

Because of icebergs, only once in about four years could the *Jelling* (at anchor on the left) enter Angmagssalik harbor. This photograph was taken one week after that on page 291, in which time the harbor had almost completely cleared of ice.

The ceiling lowered as we pursued, through rain and fog, a winding, tortuous course southwest. I had no idea where we were, and felt sure we would eventually land on the plateau.

Finally we came upon a river, cutting its way down a canyon several hundred feet deep—flowing west! We had passed the divide and knew that the river would inevitably lead us out to the west coast of Spain or Portugal. We followed its winding course for half an hour down into broader valleys. The fog became lower as we approached the sea and the visibility worse as the afternoon progressed. Suddenly, as the fog ahead dropped down to the treetops, my husband, with a quick gesture to me, circled to land on the broad stream.

We were flying rather low and I had 150 turns of antenna trailing out below the ship. In a panic I wound frantically but could not reel it all in before we struck the water. The ball weight on the end snapped off—the first one I had ever lost. We taxied upstream to a still pool out of the current, while people from both sides of the river began to row out to us. I reached for a small Spanish dictionary and shouted with appropriate gestures, "Mal tiempo—Santoña—Lisbon—Mal tiempo—No puede—Lisbon—Aquí" and then hopefully, "Persona inglesia?"

PLANE WINGS TIED TO WILLOW STUMPS

Perhaps they understood; or just on general principle rowed back to the nearest town for someone who could speak English or a strange mixture of Portuguese and "New Yorkese." In the meantime my husband was much more successful without a dictionary. Taking out a map, he made them show him where we were: Rio Minho on the border between Spain and Portugal; just upstream from two small towns, Túy on the Spanish side and Valença on the Portuguese.

We pulled the plane up against a bank in a small inlet off the main stream, and tied the wings to low willow stumps. Here we were quite comfortable for the night, spreading out our bundles for a mattress in the long baggage compartment—the large bulky bundles underneath, and the softer ones—slickers, white parkas, flying suits, air cushions, and life preservers—on top.

In the morning we were waked by the murmur of voices, at first low, and then rising to a chatter like that in a theater before the curtain goes up, which, as a matter of fact, was exactly the case. Peering out of an opening we could see crowds of people lining both banks of the inlet and a small rowboat doing a busy trade of ferrying them from the opposite side to ours.

MEETING CAMERAS WITH A CAMERA

Men, women with babies in their arms, children and dogs, all stood waiting for us to appear out of the plane. I dressed, knocking my elbows on the sides of the narrow fuselage, with the feeling that there were hundreds of eyes turned upon me, shielded only by the thin walls of the plane. There were numerous cameras set up ready to snap at us as we popped our heads above the cockpit. My husband surprised them by jumping up quickly and taking their pictures before they could take ours. I think, on the whole, we got the best picture.

But the crowd on the bank, we soon discovered, wanted to do all they could to help us. The mayors of both Túy and Valença, the international police, the river boat patrol, the customs officers—everyone turned out to give us a good time during our chance visit (see illustrations, page 318).

"Now youse—Missa Annie—don' be bashful—you wan' anyt'ing? If youse like—I taka youse out riding."

When the weather cleared a little, we left for Lisbon (Lisboa),* which was only two hours away. The great bay sparkled with boats and sunshine. Good weather at last and a wonderful rest, at the American Legation, before our flight to the Azores.

On November 21 at 7:08 G.M.T. (daybreak) we left Lisbon for the Azores. Accurate navigation probably was more important on this trip than on any other, for the point we aimed at was small, and we did not have enough fuel to return after going the full distance. It was essential to strike the islands.

We relied primarily on dead reckoning checked by sun sights with our sextant. We also had radio contacts, carefully arranged by the Naval Station in Lisbon, to help us. I operated the radio and drift meter and flew the plane while my husband took sights on the sun.

* See "An Altitudinal Journey Through Portugal," by Harriet Chalmers Adams, in the NATIONAL GEOGRAPHIC MAGAZINE for November, 1927.

Photograph by Charles and Anne Lindbergh

ON LONG SUMMER EVENINGS THIS WHITE BRIDGE SHAKES TO THE RHYTHM OF A GREENLAND "PAUL JONES"

When the flyers dropped anchor, they heard villagers singing "The Boat Is Coming In with the Whale" (see text, page 271). This largest settlement of Greenland has electric lights and a fountain in the little square (see text, page 283). It is only in this district that fresh milk may be had in Greenland.

Photograph by Charles and Anne Lindbergh

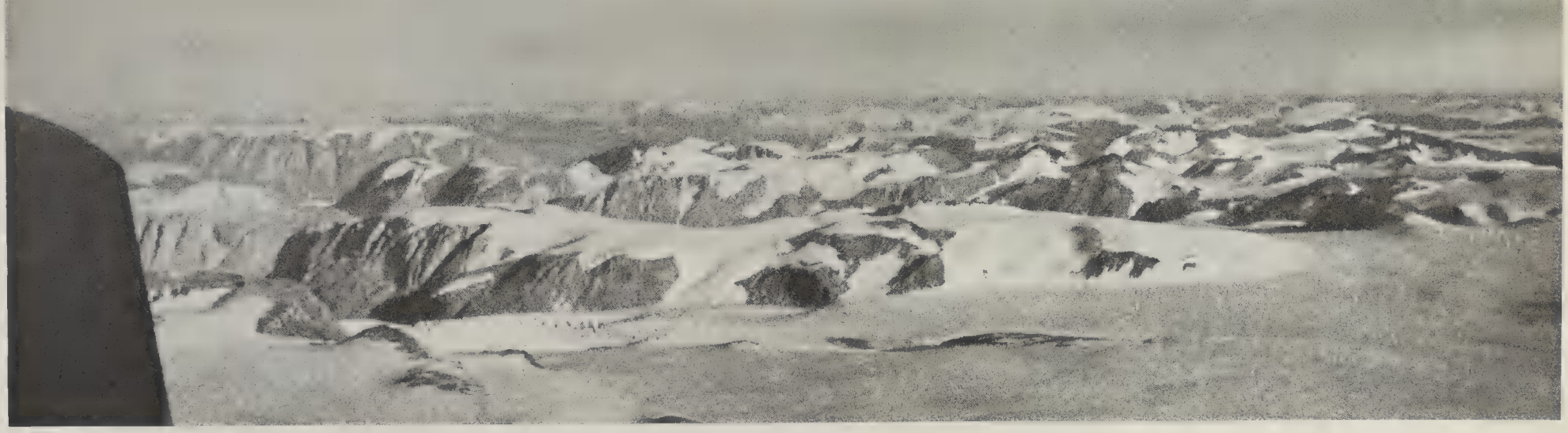
GREENLAND'S ONLY FOREST LINES THE STREAM IN THIS DEEP VALLEY

Eric the Red may have viewed this green canyon when he landed south of Julianehaab some ten centuries ago. The thickets of willow and birch "trees," carpeted with ferns and moss, never grow higher than 18 or 20 feet. The light clouds are remnants of sea fog which has drifted in and been broken up among the high mountains.

Photograph by Charles and Anne Lindbergh

FAREWELL TO GREENLAND'S BLACK PEAKS, HER ICE CAP, AND PATCHES OF BLUEBELLS

A melting glacier tongue forms Lake Fjord, which was the base of the British Watkins expedition (see page 284). It nestles in a valley whose slopes were furrowed out by scouring ice of former years. This parting view of Greenland was taken as *Tingmissartoq* winged its way toward Iceland.



THESE RUGGED MOUNTAINS WERE A WELCOME SIGHT AFTER SEVEN HOURS' FLYING OVER GREENLAND'S ICE CAP

As the flyers approached the east coast, Colonel Lindbergh passed a cheering note back to his wife: "Every five minutes we save a day's walk."

Photographs by Charles and Anne Lindbergh

THE "CHARMING GRAY-ROOFED, GRAY-WALLED TOWN" THAT IS LERWICK

When *Tingmissartoq* moored for an overnight stop, crowds lined the short streets of this village in the Shetlands, famous for shaggy little ponies and herring fisheries.

Photograph by Charles and Anne Lindbergh

FLOATING ICE ISLANDS ARE NEARLY AS HIGH AS THE UNITED STATES CAPITOL

Despite their enormous size, these east-coast bergs are much less dangerous to transatlantic shipping than calvings from west-coast glaciers. Wind and current carry them around the southern tip of Greenland, up the west coast, and, if anything is left, into the warmer waters of Davis Strait—their journeys' end far north of steamship lanes.

In the first part of the day, we had to fly above the clouds in order to take sights. But in the afternoon, under clear skies, we flew very near the water, using the natural horizon for our observations. After eight hours we saw the volcanic slope of Terceira rising into the clouds. At 16:25, a little over nine hours from our take-off, we landed in the harbor of Horta, a steep hill behind us and a steep cliff ahead of us.

We had thought of going from Horta straight to Madeira, but the harbor at Horta was too small for us to take off with a sufficient load of fuel, and the swell outside was too great. We decided to refuel at Ponta Delgada, an hour-and-a-half flight from Horta. We arrived in the evening and left early the next morning for Madeira. Here again navigation was important, but this time there was always the coast of Africa to catch us should we miss our island. Due again to the great assistance of the Portuguese naval radio stations, we had accurate weather reports, and could send back our position en route.

We had a beautiful day and, with the sextant checking our dead-reckoning positions, in about four hours saw the bluffs of Madeira straight ahead of us.*

This steeply terraced island looked very charming; but the small breakwater at Funchal hardly kept out the rolling sea swell. It looked too rough to land and much too rough to take off again. We circled, radioed our regret at not being able to stop, and went on to the Canary Islands. About seven hours after leaving Ponta Delgada we landed at Las Palmas. Here we entered into a zone of permanently good weather, clear and dry and sunny. It was deliciously warm and not yet hot. At Villa Cisneros, our next stop, it began to be hot.

On November 26 we left Las Palmas for Africa. The coast of Spanish Rio de Oro looked like Africa—brown-yellow sand as far as one could see, falling down abruptly in low cliffs to the sea.

Villa Cisneros (page 324) lies on the spit of land between the mouth of the Rio de Oro

* See "Madeira the Florescent," by Harriet Chalmers Adams, in the NATIONAL GEOGRAPHIC MAGAZINE, July, 1934.

Photograph by Charles and Anne Lindbergh

ICELAND'S VOLCANIC PLATEAUS CONTRAST WITH GREENLAND'S ICY PEAKS

Many lava flows, laid one upon another, have leveled off the northwest coast of Iceland until it looks like a table top. These rocky tracts often reach heights of 3,000 feet.

and the sea. Nothing but a few flat-topped white buildings, a group of brown tents and a large hangar on the sand. The hangar represented a regular stop on the French air route to South America; the white buildings, a large square Spanish fort and its surrounding houses. Farther along the peninsula, from sea to bay, stretched a row of smaller white forts, joined with a wide barrier of barbed-wire fencing. Here, apparently, the Spanish traded with the Moors. "And that," so read the African pilot book, "only under their guns."

Beyond this boundary line the real desert began. Looking down that stretch was, in its endlessness, like looking out to sea. Trails ran off in the sand and on the horizon, a group of figures, men and camels on the way—out.

"INFINITE DIGNITY" OF THE MOORS

We landed in the middle of the morning. The light was intense; bright water, bright sand, bright white houses. One looked for relief to the sharp line where the cliff made a shadow on the bay, to the dark cool cave of the hangar, and the black tents of the Moors. Even the clothes of the Spaniards were white. They are undoubtedly cooler, but not as easy to look at as the dark evening blues that swathe the Moors.

The Spanish Governor and his family welcomed us to the fort with the greatest cordiality, while the Moors, huddled in the small corners of shade, sat motionless as we passed. Veiled up to their eyes, they did not turn their heads and yet seemed to be aware of us. Even when we met them moving gracefully across the sands with their camels, they never stopped to look at us, or showed by any sign that they noticed the two strangers in their settlement. The infinite dignity of their manner was as restful to the emotions as their dark clothes to the eye (see illustration, page 327).

In the evening the sand glowed softly, a dull gold, and the sky and sea deepened to a dark-green blue. The cool air rested on one lightly. Out of the shadows rose the Moors in their flowing robes, like part of the evening, and came to greet us at a meeting. They listened quietly, with interest but no excitement, while the Governor explained to them where we came from and where we were going. Then one of the Moors, who had been in French Africa, rose

Photograph by Charles and Anne Lindbergh

LEAVING THEIR FISH TO DRY ON THE ROCKS, THESE HARDY VILLAGERS CROWD ESKIFJÖRDUR'S PIER TO EXTEND A WARM WELCOME

As the plane's motor stopped, the flyers heard the roar of many mountain streams tumbling down the steep hills. Next morning they were off for the Faeroe Islands and Europe.

Photograph by Charles and Anne Lindbergh

WHITE PATCHES OF DRYING FISH BRIGHTEN BLEAK SLOPES

Coastal storms forced the Lindberghs to spend the night at the fishing village of Eskifjördur, sprawled along the bank of one of many deep fjords. Icelanders have conquered the hostile land and put its rugged resources to use. Cattle graze on volcanic plateaus, hot springs heat greenhouses, waterfalls supply power, and crops are cultivated on thin-soiled, stony fields (see text, page 285).

A CLEAR DAY IN THE FAEROES, RENOWNED FOR FOG

The previous day the Lindberghs squeezed under a 200-foot ceiling and landed on the choppy waters at Tverå.

Photographs by Charles and Anne Lindbergh

WAITING FOR THE COLONEL TO "GIVE HER THE GUN"

The little fellow in the dark suit (right center, front row) and the lad peering over his right shoulder seem genuinely concerned for the safety of the Lindberghs, but the sturdy young lady with blond hair (left) knows the take-off at Tverå will be perfect.

and spoke to us. The heads of all the tribes, he said in French, wanted to welcome us and to wish us a good journey.

THE MOST THRILLING HALF HOUR

The next morning we left for the Cape Verde Islands. It was a beautiful day and the trip was uneventful except for half an hour which was, for me, one of the most thrilling of the summer. In between my regular contacts with Las Palmas, I was sending out CQ's (General Call) on short wave, hoping that one of the Pan American stations on the coast of South America might perhaps hear, although we had not planned any schedule.

Listening on 24 meters at 11:30 G.M.T. I heard very plainly WSL at Sayville, Long Island, also sending out a CQ. That was not so very unusual. It was a big station and I had heard it several times during the summer. I decided, rather recklessly, to call him.

"WSL — WSL —WSL—de—KHCAL—ans (answer) 24." I tapped it out easily, confident that my 15-watt transmitter would never reach him. Silence—and the CQs at the other end stopped. Then clearly:

"KHCAL — KHCAL — KHCAL—de—WSL." He was answering! I was hot and cold from excitement and did not dare touch the set, lest it should break the contact.

"QRK" (I receive you well, your signals are good), he went on. "QRU"? (Have you anything for me?)

QRU—casually, like that! Though I realized that naturally he was not excited. He heard ships as far away as this every day. I would let him know, anyway, that we were not just around the corner at Atlantic City.

"Lindbergh plane—en route Cape Verde Islands—min pse" (please wait a minute). Then, signaling my husband, I received a message to send him for New York and got back the "received OK." Over 3,000 miles away! I couldn't believe it. We arranged for another contact in an hour and signed off.

I decided to leave the set as it was—not to move anything—just as, waking in the middle of a good dream, one tries not to move one's head on the pillow, hoping it will come back again. Then I remembered I had not yet contacted the Cape Verde Islands for their weather. I changed the coils and the antenna. I know I put them back again in exactly the same position for my next contact. Changing them probably made no difference—but I cannot help regretting it. It was fatal, just like turning over in one's sleep; I never contacted WSL again.

In the late afternoon we flew over Santiago in the Cape Verde Islands. The harbor of Porto Praia, where we had planned to land, was small and open to the sea. A big swell rolled right up to the beach. A few miles west we saw a tiny opening in the rocky coast, at the end of which was a hangar and derrick—the French transatlantic seaplane base (page 328). We could not possibly land inside the harbor, but it offered a protected mooring for the plane.

ROLLERS AND WIND HANDICAP LANDING

We picked out a stretch of water, which looked a little calmer than the rest, between two points of land, and landed, the ship spanking hard on the rollers. Even then it was difficult taxiing into the narrow entrance, for there was a strong northeast wind blowing (see page 325).

This hot, dry trade wind blew steadily all the time we were there. We went to sleep listening to it. As we lay in our plane, baked hot by the unrelieved sun, I would wait in vain for the long roar to break, like a wave on the beach. But there was no relief from it.

Every morning we woke and looked out to sea hoping for a calm day. Always, the heavy swell and the wind. It seemed to make everything harder work, on the plane or climbing up the hill to the radio station—as if one were pushing against it all the time. I had the feeling sometimes that we must be on the prow of a ship, steaming forward. Motion only could create that constant wind. And sometimes, as though it were not an outward physical force but an inward illness, a fever, a pressure on my temples.

"Is it never calm here?" we asked. We had stationed our fuel at Porto Praia and hoped to take off for South America from this point.

"Yes, it is sometimes calm—but never this time of year. It will blow like this for six months."

"And no change? No storm or change in the wind?"

"Never—always like this."

We began to realize that, as we could not take off from these rollers with sufficient gas to reach South America, we would have

TVERÅ'S HOMES SEEM TO LEAN BACKWARD TO KEEP FROM SLIPPING OFF

From the west to the east coast of the Faeroes, *Tingmissartoq* followed a fjord similar to this—"like a tunnel through the fog."

Photographs by Charles and Anne Lindbergh

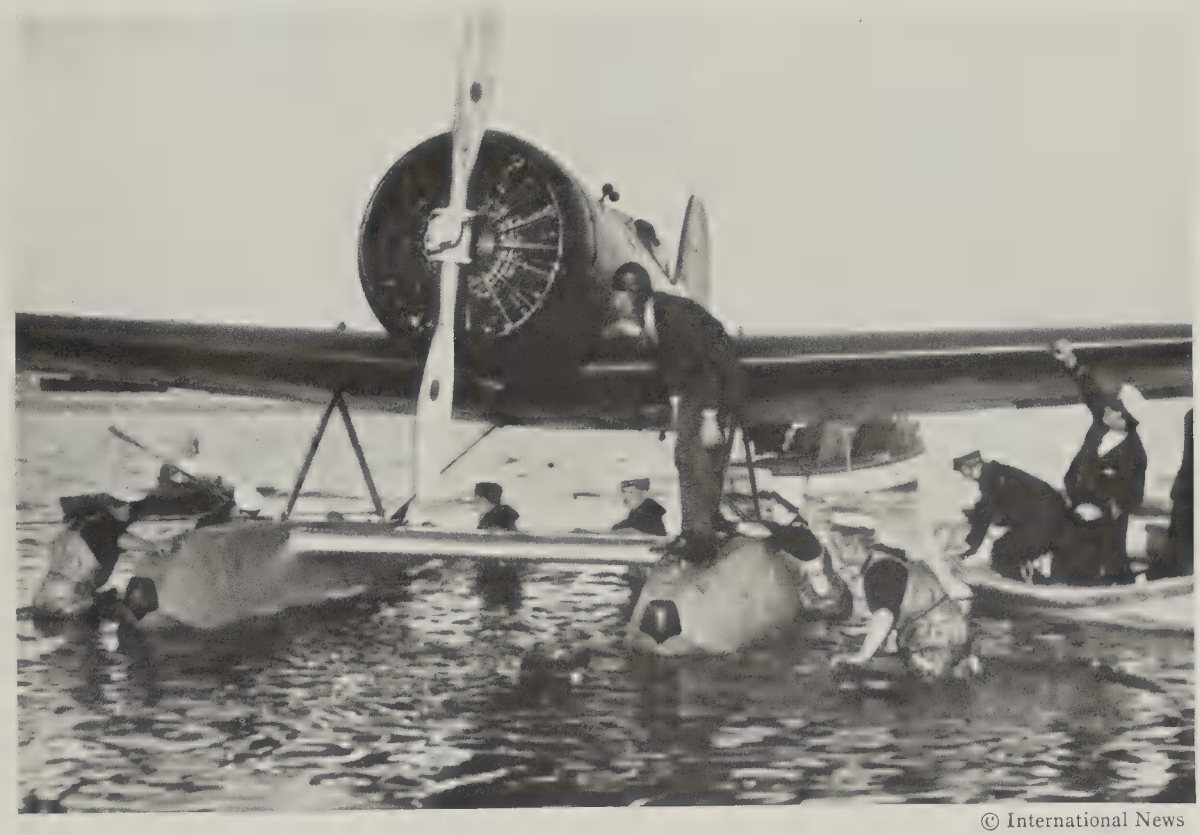
WINGED CLIFF DWELLERS HONEYCOMB THE FAEROES' ROCK WALLS

Thumping waves tear away the base of these soft rock peaks a thousand feet below the ledged home of birds—source of meat for the islanders' winter board.

Photograph by Charles and Anne Lindbergh

"LIKE MYRIADS OF WHITE BUTTERFLIES AND GNATS ON A SUMMER'S POOL"

In boats resembling the Eskimo kayak, Copenhagen youth paddle out into their harbor to greet the Lindberghs, ending a 600-mile flight from the Shetland Islands.



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"TINGMISSARTOQ" ABOUT TO GET ITS FIRST SHORE LEAVE SINCE NEW YORK

Colonel Lindbergh watches mechanics of the Air Force of the Danish Navy slide a cradle under its pontoons prior to hauling it into a hangar at Copenhagen.

Photograph by Charles and Anne Lindbergh

THE FLAT FIELDS OF SKÅNE PROVINCE MAKE A MOSAIC CARPET—WHERE A SEAPLANE COULD LAND SAFELY

This little village in southern Sweden shares in growing a third of all the wheat and barley produced by the country. Just over the Sound from Copenhagen, the old province sprawls flat and low across the southernmost tip of the Scandinavian Peninsula. Shadows of windmills mass black across its pastel

Photograph by Charles and Anne Lindbergh

WEDGING OUT TO THE WATER FRONT, STOCKHOLM'S LIFE SPILLS OFF INTO SHIPS

"Spires and ships and towers and bridges and pine trees, all set down in sparkling water"—such was Anne Lindbergh's impression of teeming Stockholm from the cockpit of *Tingmissartoq,* flying over the city. Nearly forty miles from the Baltic, the city thrives at the junction of the sea and Lake Mälaren.

Photograph by Charles and Anne Lindbergh

STOCKHOLM'S TOWN HALL TOWER HOLDS A HIGH FINGER TO CIVIC PRIDE

Neither unsightly wharves nor unpleasant odors mar the beauty of Stockholm's water front, kept spotlessly clean the year round. A wing of the House of Parliament (left) reaches toward the tower, and the Royal Opera House abuts the quay (right).

© Sovfoto

THRONGS OF RUSSIANS JAM A BRIDGE OVER THE MOSCOW RIVER TO BID ADIEU TO THEIR FLYING GUESTS

Tingmissartoq has been taxied down close to the bridge and is swinging around into the wind, its metal propeller churning the air. The roar from the big Wright Cyclone engine mingles with the shouts of the crowd. The Colonel banks his plane, dips a wing in farewell salute, and heads west.

© Sovfoto

"THE ENTHUSIASM OF THIS RECEPTION . . . REMAINED IN OUR MINDS"

Roaring cheers from a large crowd at the Dynamo Stadium, Moscow, were echoed by other crowds on the opposite bank of the Moscow River, where the Colonel completed a skillful landing by skimming the top of one bridge, side-slipping steeply, and leveling off to the water (see text, page 293).

to go back to Africa and start from there, even though it would be 200 miles farther.

BACK TO AFRICA FOR A TAKE-OFF

On the morning of November 30 we left Porto Praia, bouncing several times as much as ten feet in the air, striking one roller after another. Each time I thought we were off we would come down again with a worse spank than before. Finally, stalling off, we headed for Bathurst.

Originally we had planned to go to Dakar, but after being warned of the yellow fever epidemic and quarantine there, we changed our plans and obtained authority to land in British Gambia. After about three hours' flying, we saw Cape Verde, stretching out to sea ahead of us, then the flat green shores of British Gambia.

In the early afternoon we landed on the muddy river at Bathurst.

Bathurst, with its harbor full of little boats; its gently waving palms; busy, well-ordered streets; white-uniformed, sun-helmeted officers; throngs of negroes in many-colored robes; freshly painted houses and neat fences; cricket grounds; cool, lovely Government house and the British flag—all breathed an air of peace, order, and security.

It was amusing later to see the accounts in the newspapers of our trials in the mosquito-filled marshes. We could not have had a more comfortable, restful haven in which to study the problems of a South Atlantic crossing, nor, which was most important, more helpful and sympathetic people around us (see illustration, page 330).

The greatest problem was the time of take-off. We had only a little over 13 hours of daylight to count on for the trip. If we went as fast as possible, we could perhaps accomplish the whole trip, including take-off and landing, by daylight. But we would have too small a reserve of fuel in case we encountered strong head winds or found it necessary to detour storm areas.

THREE CHOICES FOR TIMING FLIGHT

We abandoned this possibility, although it was attractive with its shorter hours. We must have that extra margin of safety. The speed for greatest fuel economy was about 100 knots. At that rate it would take us

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"TINGMISSARTOQ" WAITING FOR A TOW IN BRITISH WATERS

The motor launch is swinging around, kicking up the froth at its flat stern, as a greeting party prepares to throw a tow line to the seaplane. This first stop in Great Britain was at Woolston, near Southampton.

about 16 hours to reach Natal, the nearest point in South America.

The alternatives left to us were: first, to leave at night and arrive in daylight, in which case our take-off would be the most difficult part of the trip; second, to leave in daylight and arrive at night, which would necessitate locating our position on the coast of Brazil and making a landing in darkness; third, to leave at sunset, fly through the night, and arrive at daybreak. Originally this plan seemed the best.

The take-off, the ascertaining of our position on the opposite coast, and the landing—most difficult parts of the trip—would be in daylight. Navigation with the stars by night would also give our position more accurately than with the sun by day.

Another factor entered into this general problem of light. We had a full moon, which made a night take-off perfectly practicable, and a night landfall and landing comparatively simple.

As a matter of fact, the local conditions, wind, sea, and atmosphere, had more influence on us and were harder to gauge than the other problems. We needed a wind to help us take off our heavy load; but we did not want a sea swell like that off the Cape Verde Islands. There was not much wind in the harbor at Bathurst. It was usually—so we were told and according to our observation—dead calm at twilight, when we had hoped to take off. We would have to leave, we soon discovered, either at daybreak or at night when there was usually more wind.

After a day or two of preparation we were ready. The plane was refueled; radio schedules with the Pan American stations on the South American coast, with Bathurst, and our friend at the French seaplane station at Porto Praia were already arranged. We had also asked for daily weather forecasts from Pernambuco (Recife) and Pará (Belém) on the South American coast. The encouraging word came back, "Weather Pernambuco—Pará—always good—never fog—."

We decided to try to take off at daybreak, the time of most wind, with all fuel tanks full, part of which we could unload if necessary and still have a safe reserve. The morning of December 3 we taxied out into

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THE COLONEL SETS THE PACE

Escorted by British officers, the Lindberghs go ashore at Woolston, near Southampton, to visit the Supermarine Aircraft Factory.

Photograph from Wide World

JUST BEFORE THE PONTOONS HIT THE SEINE

Two French sailors straddle *Tingmissartoq's* tail, lest its heavy nose hit the water too soon. Colonel Lindbergh slips on a waterproof coat in the front cockpit while directing the work of lowering his plane at the seaplane base, Les Mureaux, near Paris, France.

the bay, the pontoons almost submerged under their heavy load, the plane heaving bulkily from side to side as we taxied across the wind and waves. After several hopeless attempts to take off—the spray sluiced down over the wings continually and we never got up on the step—we turned back to the mooring. Unloading our extra gasoline, we tried again. But the wind had dropped by then, and though this time we got up on the step we could not get off the water. We decided to go back and wait for a wind.

That night at midnight, we tried again with the moon just past full, lighting a path for us on the water. I watched the red light on the wing-tip glow, disappear, and glow again as the spray passed over it, and held my breath to lighten the load. It was no use; after several attempts we taxied back to the lights of the town.

"What was the matter, Colonel?" asked a friend who had kindly stayed to watch us.

"Overload, that's all," answered my husband. "We've taken off with that much before (in Greenland). But it's different down here in the Tropics; different air."

We drove home through the dark streets in silence and went to bed very tired after our long unsuccessful day.

"We still have a few tricks to try," said my husband.

I wondered what they were. We could not take out any more fuel without cutting down our reserve of safety. We could not leave out the emergency radio set, or the boat, or any of the food or water. What could we do?

In the morning we began to get telegrams: "Suggest barnacle inspection," and from the propeller company, "Press reports you using wood propeller." (Colonel Lindbergh was seen filing the splinters off his wood propeller!) "Please cable why steel propeller unsatisfactory." The tip of our metal propeller had been somewhat eroded by the spray in the long take-offs, and it was necessary to file it down.

My husband spent the day inside the plane, cutting out an unused gasoline tank, piece by piece, with tin snips. It was very hot with the sun beating down fiercely on the outside of the ship, and the fumes from the empty tank were suffocating. He was tired at the end of the day, but much more cheerful at the thought of the saved weight. We decided not to try until the next night. Although the moon was waning, a good sleep seemed more important.

LIGHTENING THE LOAD

By the next evening we had cut out even more weight: some emergency chocolate (there was still enough food and water left for a month); the anchor; the rope; the tin bucket: a great many tools; the flying suits; the sleeping bag; all our clothes, except the ones we wore; our duffel bags, and many other things—a total of about 150 pounds.

The day seemed unusually calm, the tops of the palms hardly stirring. At sunset, when I walked out on the pier, there was not enough wind to lift a handkerchief. The moon rose about nine, reddish and grown lopsided since the night before. "It's certainly the last night we can use that," I thought.

"We could still take off at daybreak, couldn't we?" I asked my husband.

"No," he answered. "You see, the moon rises later every night—and it wouldn't be light enough when we reach the other side to land by."

There was never any wind at sunset; this seemed to be our last chance as far as Bathurst was concerned.

We left Government House at 10:30, local time, carrying only what we wore, some lunch, and two sun helmets. It took us a long time to get started after we reached the plane. First we pumped out the pontoons. They were loaded so heavily that the back ends had to be lifted out of the water by a rowboat under the tail. Next, we sealed up the anchor box in the pontoons with putty, to prevent water from leaking in during taxiing.

"There's about a five-mile wind right now," said my husband cheerfully to the Captain of the Port, who had come out to help us.

Our friend held up his hand. "You air folks must look at it differently," he replied.

"Why? What would you call it?" my husband queried.

"Almost a dead calm."

We all laughed. My husband took off the lantern and the plane's mooring bridle and handed them to the Captain.

"If we come back we'll want these; otherwise—" he stopped for a moment and then —"we'll have another try, anyway"—and off we went.

Photograph by Charles and Anne Lindbergh

PORTUGAL PROVIDES AN AUDIENCE BEFORE BREAKFAST

When they awoke and looked out of the cockpit, the Lindberghs were greeted by this group gathered on the Minho River bank. The Colonel aimed his camera at the crowds and obtained his picture first (see text, page 297).

Photograph from Wide World

FORCED DOWN BY FOG AND STORM ON THE MINHO RIVER, PORTUGAL

Tying its wings to low willow stumps in an inlet off the stream, *Tingmissartoq's* occupants spread out slickers, white parkas, flying suits, air cushions, life preservers, and called it a day on their improvised mattress. At daybreak the spectators began to gather.

Photograph from Keystone-Underwood

"TINGMISSARTOQ" LANDS AT A MID-ATLANTIC PORT

A stop for fuel here at Ponta Delgada, on the São Miguel Island of the Azores, was made necessary because Horta's harbor, on Fayal Island, was too small to take off with gasoline enough for a non-stop flight to Madeira as originally planned.

Photograph by Charles and Anne Lindbergh

SENTINELS OF THE ENGLISH CRUSADERS MAY HAVE GUARDED THIS WALL

While guests of the American Minister and Mrs. Robert G. Caldwell in Portugal, the Lindberghs visited Óbidos, a small town about 45 miles from Lisbon. On their way to Palestine, in the 12th century, Crusaders stopped in Portugal to aid in driving the Moors from Lisbon.

Photograph by Charles and Anne Lindbergh

THROUGH A HOLE IN THE WALL OF A PORTUGUESE FORT

While walking along a battlement of the fort at historic Óbidos, Colonel Lindbergh came upon this view of a windmill—like a framed picture. Fort and ruined walls may have been the scene of the battles in which Crusaders joined native armies to establish Portugal's independence (p. 319).

I looked back in the tail to be sure that everything was securely lashed; sat on my extra shirt; stuffed the lunch into the map case; put the radio bag in the seat beside me, and fastened the belt. The lights of the town were on our left and, above them, the palms were outlined quite plainly in the moonlight. Out in the bay there was more wind. We turned, slowed up, throttled down. A pause for breath.

"All set?"

"Yes, all right."

"WE'RE OFF"—AFTER A STRUGGLE

Then the roar—the spray. I watched it over the wing and looked down at my watch. The spray stopped. We were spanking along—up on the step—a good deal faster than before. Sparks from the exhaust. We're going to get off! I thought in a flash of realization. But how long it takes! We're off? No—spank—spank—spank—but almost—.

I held my breath. We're off! No more spanks. I looked at the watch—just 2:00 G.M.T.

Yes, we're off—we're rising. The engine smoothed out into a long sigh, like a person breathing easily, almost like someone singing, ecstatically. We turned from the lights of the city. The plane seemed exultant, then, even arrogant. We did it—we did it! We're up above you—we were dependent on you, just now, River, asking

A WARNING TO SEA CAPTAINS BETWEEN THE MADEIRA AND CANARY ISLANDS

A volcanic peak has shoved its grotesque nose above the pounding sea where it breaks over one of the lonely Salvage group. The white line running through its sand and gravel floor is a trail worn by fishermen from the Canaries who go to the island during the summer. A corner of *Tingmissartoq's* tail surface shows at the left.

Photographs by Charles and Anne Lindbergh

ROLLING SEAS PREVENTED A LANDING HERE

Funchal's little harbor on Madeira seemed to the Lindberghs too small for a landing, so *Tingmissartoq* dipped its wings in greeting and proceeded to Las Palmas, in the Canary Islands.

Photograph by Charles and Anne Lindbergh

MADEIRA'S TERRACED GARDENS LOOK LIKE ROWS OF SEATS IN A FOOTBALL STADIUM

These red-roofed houses huddle together on a shelf between the bluffs and the sea. However, most of the villages on this coast lie at the top of the cliff.

Photograph by Charles and Anne Lindbergh

WALLS OF BEECH TREES AND VOLCANIC ROCK PROTECT PONTA DELGADA'S ORANGE GROVES

A curved breakwater shelters two warships in the harbor—the Portuguese convoy sloop which had maintained radio contact with *Tingmissartoq* between Lisbon and the Azores, and the French sloop which the Lindberghs first met in Greenland (see page 289). The flyers caught a night's rest here before taking off for the Canaries, last island stepping stone to the African continent.

Photograph by Charles and Anne Lindbergh

FIRST AFRICAN STOP—ON A SPIT OF LAND BETWEEN THE MOUTH OF THE RIO DE ORO AND THE SEA

The Tropic of Cancer cuts across the Spanish Colony of Rio de Oro on the West Coast of Africa. Here, at Villa Cisneros, the flyers brought their plane down in glaring morning light, near the white Spanish fort (right center). Beyond the fort is a hangar and landing field of the French air route to South America. Like

Photograph by Charles and Anne Lindbergh

"TINGMISSARTOQ" GOT A SOUND SPANKING COMING DOWN ON TOP OF THE ROLLERS OFF THE CAPE VERDE ISLANDS

Hot, dry winds, always from the same quarter, blow steadily across the islands for six months, smashing breakers against a rocky coast. The flyers gave up plans to reach South America from here and returned to the African coast. The white shed is a hangar built by the French as a transatlantic seaplane base.

Photograph by Charles and Anne Lindbergh

AN AFRICAN FISHERMAN TAKES A REEF IN HIS SAIL

Fish are a means of livelihood to a part of the 50,000 wandering tribesmen who roam the desert and coast lands of Spanish Rio de Oro. These turbaned nomads are for the moment more interested in the Lindbergh plane than their fishing.

you for favors, for wind and light. But now, we are free of you; we are up—we are off. We can toss you aside—you, River—there below us, a few lights in the great, dark, silent world that is ours—for we are above it.

My husband switched on the cockpit lights to check the instruments and our compass course. Then, quickly, off again. We were flying quite low over the strip of land between the river and the ocean. I decided not to turn on my lights until we were over the water. They might make it harder for my husband to see. Still very excited, I wrote down by moonlight my first message, "Left Bathurst 2:00 G.M.T."

Looking at it on the top of the bare sheet of paper, I realized that there was no reason to feel so elated. We had the whole trip ahead of us. This was just the beginning.

I called an African station and, hearing no reply, sent out this first take-off message "blind." Then I began to call the Pan American stations on the South American coast, not hoping to get any answer so early on our trip, but because we had arranged a schedule each hour on the hour as soon as we were in the air.

At three o'clock, however, I heard a reply. The static was very bad, but in the welter of sounds I heard my name—KHCAL, friendly and comforting, across the ocean and through the dark. The first radio contact. What was it? PVB, Bahia (São Salvador), down the coast of Brazil. Right on the watch—good for him! I thought. I poked my husband excitedly and passed forward a note: "I have Bahia! Any message?" We were over the water now and I switched on the light to send our first position.

"Posn 03:00 G.M.T.—12° 17′ north—17° 50′ west—course 224° true."

A VIGIL IN A MOONLIT CABIN

From then on, through four hours of darkness, I stayed bent over in front of the dials, straining to hear through the crashes of static, sending the position reports every hour, and picking up a few words of the weather reports sent back to me from Brazil—"Visibility good."

Only once, looking out, I saw the lights of a ship far down below us. But without looking, I knew the weather was good, for the moon lighted the cabin dimly.

Photograph by Charles and Anne Lindbergh

THEIR MANNER IS AS RESTFUL AS THEIR CLOTHES

The Moors of Villa Cisneros scarcely showed that they noticed the two strangers from another continent, except upon such occasions as this when the flyers were taken by the Spaniards to meet the chiefs.

After four hours the radio began to be much better. I could hear Rio now, and, relaxing, began to realize that we had really taken off and were on our way to South America.

About 5:30 G.M.T. we began to hit clouds. Flying under them we lost the moon for periods. The periods became longer. I could still see a kind of horizon where water met clouds, a difference in darkness. Then we lost the water and flew blind. I turned off the light quickly to avoid any reflection in my husband's cockpit.

Now we were out again. There were holes below us through which one could see the dark water, and holes above us through which one could see the dark sky. More blind flying. But day was coming—it must come soon. I tried to figure it out. It should be day in an hour, anyway. We were climbing up through the clouds. I could not see to receive, but continued to send, "QRX (Stand by) QRX—going through clouds—min pse (Please wait a minute)."

More clouds ahead. More blind flying. It began to get cold. We must be quite high. I put on my extra shirt and sent again, "QRX — QRX — all OK." Then, after about an hour of this flying, my husband handed back a message to me, for Rio:

"8/10 overcast—scattered squalls—visibility three miles—daybreak."

Daybreak! I had not realized that the clouds were now distinguishing themselves, more and more, from the water and the sea. The night was over. When the sun actually rose, we were still flying through black thunder clouds, but there was better weather ahead. "Visibility unlimited outside of squalls."

The radio was good. I received intact (after repetition) a long message from Rio about the landing arrangements in Natal. It seemed very strange to be taking down the practical details of landing when we were still so far away — a whole ocean away.

"PAA barge at Natal (Would we ever really get there?) located on river at southwest edge of city (It is hardly daybreak yet) between city and large Aeropostale hangar and ramp (As though finding it would be any difficulty!). Caution tall radio masts at Aeropostale hangar (Caution!

"OUT OF THE SHADOWS ROSE THE MOORS IN FLOWING ROBES"

Evening—the sand glowed softly and the air was cool—and the Moors, like part of the evening, came to "welcome us and wish us a good journey." In the morning *Tingmissartoq* left the Rio de Oro to wing westward to the Cape Verde Islands.

Photographs by Charles and Anne Lindbergh

THE OPERATOR SMILES AFTER RADIOING NEW YORK—OVER 3,000 MILES AWAY!

Anne Lindbergh realized one of the most thrilling half hours of the entire voyage when, off the coast of Africa, she established contact with the station at Sayville, Long Island (see text, page 307). Here, on the Cape Verde Islands, the French have established a transatlantic seaplane base.

Radio masts in full daylight—caution!—after that moonlight take-off!). Few spare parts available on barge." (They sound as though they really expect us.)

This anticipation of arrival gave me a feeling of confidence. The very attention to detail took for granted our safe arrival. I ate one of my sandwiches and felt refreshed.

At 8:06 G.M.T., I heard another note coming in over the radio, a new loud voice calling me, "KHCAL-de WCC—answer 54 or 36 (meters)." WCC was Chatham, Massachusetts. I could not quite believe it and looked up in the call-book to make sure — Chatham, Massachusetts, calling me!

It seemed very unreal, but the whole night had been unreal. So I answered rather casually on 54 meters (the wavelength I was using), not bothering to change frequencies. He answered immediately, the notes coming in very loud and clear, every word intact. I did not need his triple sending, but hardly dared interrupt.

WANTED: A MID-OCEAN INTERVIEW

Chatham—think how thrilling! The sentence dribbled out slowly on the page: "Would-you-answer-answer-answer-few-few-few-questions-questions-questions—first-radio-radio-radio-interview-interview-interview-from-from-from-airplane?" Newspapers here, too! Out in the middle of the ocean. It made the whole trip more unreal than ever. I sent back my answer: "Sorry too busy here—must get weather—from PVJ."

No matter how thrilling a contact with Chatham, Massachusetts, might be, we certainly had enough to do without giving interviews. I was relieved to get PVJ (Rio) again, this time on 36 meters.

"Posn 09:00 G.M.T.—05°—00′ north—23°—40′ west—course 224° true—2/10 overcast at 1500—9/10 overcast at 8000—visibility unlimited—sea calm—wind 0—altitude 1200."

There was also the drift meter to use, sighting down carefully at the water through the eye-piece; and at this point, for we were nearing the halfway mark, the sun was high enough in the sky for my husband to take sights. I had to fly the ship and missed some of my radio schedules. It was very refreshing to sit up straight after the cramped position over the dials, and to look out at the clouds and sea.

I would have enjoyed it if I had not been trying to read the results of the sextant in my husband's expression. He did not look satisfied. In between the sights, I tried to recover the lost contacts. But, incredibly stupid and slow, I could not seem to make anything work.

My back was stiff from bending over the dials and my ears hurt from the clamp of the phones. I sent with closed eyes. And yet none of these things were very hard in themselves; they could easily be overcome, with a little will power. But when one is very tired it does not seem worth the effort. Nothing seems worth the effort.

My husband was taking the sextant to pieces in the front cockpit. What was the matter? Had the sights turned out badly? We were over halfway across and it was more necessary than ever to keep radio contact. Roused from my lethargy, I reached for the canteen. A drink of water, a little on my face, and another sandwich refreshed me. I continued calling constantly.

Our first answer came back from the African side, although much farther from us than South America. It was CRKK, the French station at Porto Praia we had tried to get when we left Bathurst.

"Posn 12:00 G.M.T—01°—30′ north—28°—20′ west—4/10 sky overcast—visibility unlimited—sea light."

After losing contact with CRKK, I began to send a CQ (General Call), signing not only with our call sign, KHCAL, but also adding "Lindbergh Plane." This had worked before. Stations absolutely deaf to KHCAL sometimes answer "Lindbergh Plane." It was like changing the fly on the end of one's fishing rod.

FIRST BOATS ON THE AMERICAN SIDE

We very quickly had a bite. "Lindbergh—Lindbergh," came back the answer, "S.S. *Caparcona*—bound Rio." A boat off the coast of Brazil—I was delighted. Everything began to be easy after this. They very kindly said they would relay our position to the stations on the coast of South America. The sextant was intact again, and my husband evidently satisfied with the sights.

"Posn 13:00 G.M.T.—00°—15′ north—29°—25′ west—1/10 overcast—visibility unlimited — sea light — wind 135° — 10 miles—altitude 800."

At about 14:00 we saw our first boat on the South American side. We had not seen

Photograph by Charles and Anne Lindbergh

THE TAKE-OFF, NOT THE MOSQUITOES, WAS WHAT BOTHERED THE LINDBERGHS AT BRITISH GAMBIA

The warm hospitality of the people of Bathurst, just above the Equator, made a pleasant task of studying the problems of a South Atlantic air crossing. White-uniformed, sun-helmeted officers direct leisurely traffic which weaves in and out of

THIS BOY ONCE WAS A DESERT NOMAD

Instead of a camel for a pet, he now has a curly-haired dog. Born in a caravan, the young Moor is a Spanish errand boy. Like many of his brothers at Villa Cisneros, his head is shaved except for the umbrellalike forelock.

Photographs by Charles and Anne Lindbergh

TROPICAL FLYING MEANT A BATTLE WITH THE SUN

Two native boys of the Cape Verde Islands help Colonel Lindbergh, who is "doping" cracks on the plywood wing covering, caused by intense heat which also constantly curled up the edges of the cloth strips.

Photograph by Charles and Anne Lindbergh

"SHE SHALL HAVE MUSIC WHEREVER SHE GOES"

A Bathurst baby rides in the back pocket of her mother's colored dress with its broad-leaf pattern. She is kept in good humor by tiny bells jingling on her wrist as the mother moves.

one since the lights below us off Bathurst, eleven hours before. A tiny white speck to our right, it looked comforting as the first sight of land to me.

At 14:20 we passed over a freighter, the *Aldebaran*. From 13:55 to 15:30 we were in contact with the *Westfalen,* the German catapult ship, which had passed Fernando de Noronha that morning. After hearing our position report at 14:00 G.M.T., they said we were going to pass very near them and gave us our radio bearing from their ship. We turned slightly off course and flew over them at 15:20 G.M.T.

In the excitement of diving down, I remember only the white wake surging behind the ship, all arms waving from the deck, and, on top, their plane and catapult. They gave us a bearing to Fernando de Noronha and to Natal and signed off with "Xmas wishes and Happy New Year."

After passing the *Westfalen* I felt we had reached the other side. We had been right on course; we were sure of our position; and the skies were "unlimited" ahead of us. I felt very happy. Only the noise of the radio in my ears was a constant annoyance. I was now in contact with Ceará (Fortaleza), Pan American station north of Natal.

I knew he was just as tired as I was, after listening for my signals all night. In fact, he was much more tired. I did not realize it until afterwards, when I found out that practically all the Pan American stations from Miami to Rio had been on 24-hour duty for almost a week during our attempted take-offs. They were on constant watch for us, not being certain when we were going to leave Bathurst.

We passed Fernando de Noronha soon after we left the *Westfalen.* Flying by a huge, round volcano, which sticks up straight on one side of a bare island, like a long French roll, we set our course for Natal. I received again from Ceará the message I had heard ten hours earlier from Rio, while we were still in the dark on the other side of the ocean.

"PAA barge at Natal (The coast of South America spread low and green in the slight haze ahead) located on river at southwest edge of the city (We came on it very quickly, following the coast only a few minutes) between city and large Aeropostale hangar

(My husband looked back and signaled with his hand, 'Five minutes more!'). Caution tall radio masts—(There they were—we were circling.)—Few spare parts available on barge." (I could see it now—a small square barge in the river, crowded with people.)

"Landed Natal 17:55 G.M.T."

Natal treated us very calmly. The people were used to South Atlantic flyers, and knew that they like plenty of sleep, good meals, and a day's rest. We were considerately given all three and left the morning of December 8 for Pará, about 1,000 miles along the coast. Except for local rainstorms, blinding in their intensity, but usually quite small, we had an uneventful trip.

Photograph by Charles and Anne Lindbergh

HER HEAD MAY STAND IT, BUT WHAT OF HER KNEES?

The woman is the delivery van of Bathurst's markets. Roads leading out of the village are often crowded with natives carrying heavy loads on their heads.

READY FOR NEW ADVENTURES

About seven hours after we left Natal, we landed on the river at Pará. From here on I had expected an easy flight, up the usual coast route—Paramaribo, Georgetown, and Trinidad—all of which we had visited three years earlier. How wonderful it would be, I thought, to come to a place I had seen before. My husband evidently did not feel the same way. Whether or not it was the rest we had in Natal and Pará which refreshed him, he felt ready for new adventures.

"How about stopping at Manáos on our way to Trinidad?" (He looked a trifle sheepish.)

"On our way!" I felt insulted. "You mean that place a thousand miles up the Amazon? How about leaving New York and stopping in Jacksonville on our way to St. Louis? I think it is a punk idea! Why?"

"Well"—(he did have a reason)—"we run a line up there now—and I'd like to see it."

"Well, I'd like to see it, too," I admitted, warming up to the idea, "and it would be fun following the Amazon. Would we come back here afterward?"

"Oh, no," he said casually. "It would be stupid to come back here so far out of our way. We'd just cut across to Trinidad."

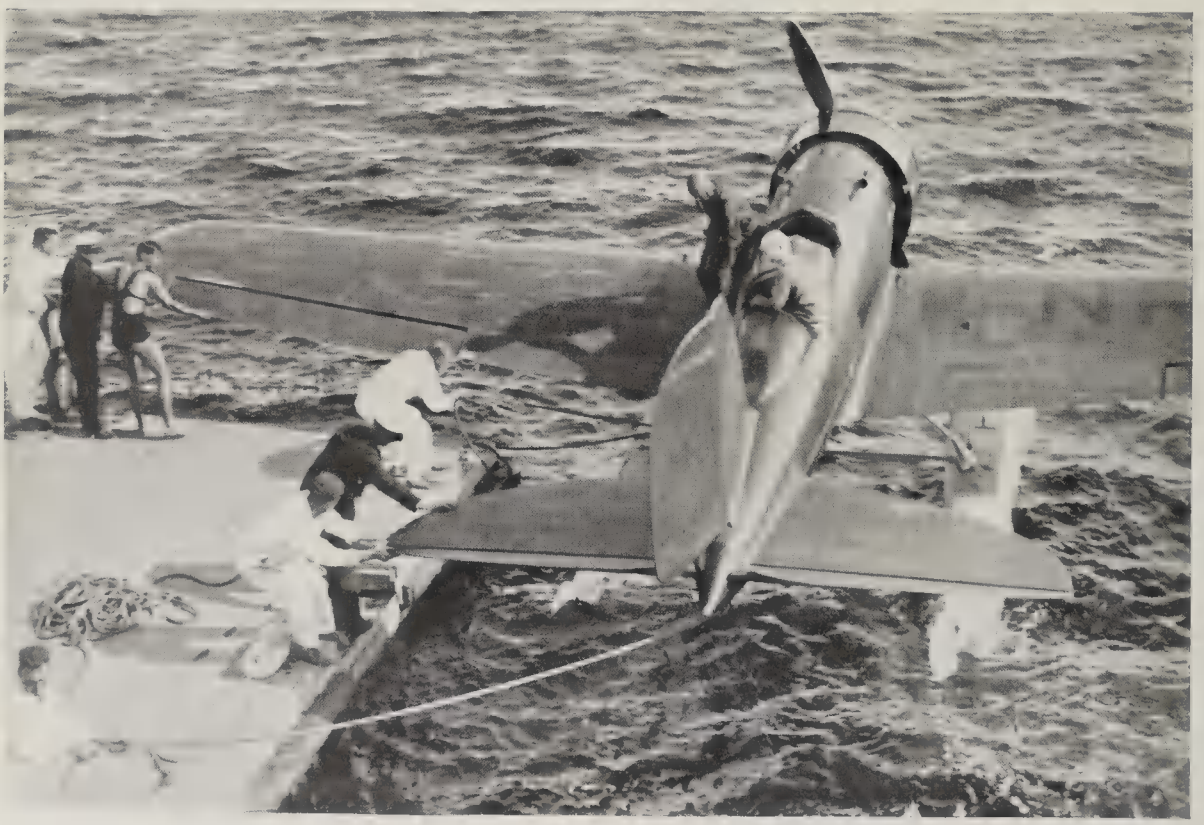
"Charles!" On my map, one of the North and South Atlantic, there was a large blank space in that thousand miles between Manáos and Trinidad—no rivers, no towns, nothing.

"It wouldn't be so bad." He did not wait for me to argue. "You'll find there are rivers all through that country, and flat spaces,

Photograph from Keystone-Underwood

FROM AN AFRICAN MOONLIGHT TO A SOUTH AMERICAN AFTERNOON IN 16 HOURS

The fourth attempt, at midnight, to get up off Bathurst's almost windless river was successful. Riding up a moonlit lane, roaring over a black sea, climbing through storms at dawn with radio crackling, droning out long hours under a tropical sun, Anne and Charles Lindbergh bring *Tingmissartoq* in for a night's rest at Natal, Brazil.



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BACK TO THE UNITED STATES, WITH NEW YORK ONLY TWO FLIGHTS AWAY!

Seven hours earlier the flyers took off from San Pedro de Macoris, in the Dominican Republic, flew along the coast of Haiti, detoured to pass over Christophe's Castle atop a high peak, and brought their rugged "ship" to port at the Pan American Airways dock in Miami

too, to land on. We could get down there anywhere—might smash the plane up, but we'd get out all right. Besides," he added, "I'd like to see that country."

"Why didn't you say that in the beginning?"

LOST—THE AMAZON RIVER!

On December 10 we took off from Pará at 11:53 G.M.T., following the Rio Pará west toward Manáos. The weather was rather bad, overcast with low rain clouds, which became lower as we progressed, forcing us down right over the water and preventing us from seeing the river as a whole. Banking and turning through the fog and rain, over the labyrinth of streams in the Amazon Delta, we followed any channel we could, keeping in the general direction of the river.

Suddenly we came to the rounded shores of a lake. Dead end! My husband looked around at me, smiled, and shook his head. Where were we? Then turning sharply, we started west, skimming right over the tops of flowering trees.

"Have you any idea where we are?" I passed a note forward. "Where is the river?"

"Do not know," came back the answer. "But am heading west to get out of delta. Will then pick up river."

The feathery wisps of fog over the jungle stretched like the waves of the sea ahead of us. But, after flying over it for some time, we could see a break in the white sea—a darker band on the horizon. Was it the darkness of a thicker band of fog, of thunderstorms, or of solid earth, showing through a gap in the mist? It turned out to be a river, the Xingú, a large tributary which led us quickly into the Amazon.

Though we were flying again under low clouds, it was easy now to pursue the muddy course. The delta with its many islands was behind us, and the river, here a single broad channel, curved peacefully ahead.

The country was flat and thickly covered with jungle, although, as we progressed upstream, there were more open stretches and green marshes, and hills began to rise on the horizon to our right. At about 19:20 we came upon the junction of two rivers. A jagged line midstream marked the advance of the blue waves of the Rio Negro into the muddy waters of the Amazon.

Just beyond the junction, on the steep banks of the Negro, was Manáos. We had passed only small river villages and scattered huts on our way up the Amazon. After them, it was rather startling to see a city as large as Manáos. White stucco houses, towers, smokestacks, a rubber factory, the dome of an opera house, a large pier crowded with people, and a big river boat at anchor—all set down in the middle of the jungle.

On December 12, after a day's work on the plane, we left Manáos at 9:48 G.M.T. (daybreak) for Trinidad. We flew up the Rio Negro—through scattered squalls—to the Rio Branco, which we followed north.

"Posn—12:10 G.M.T.—following Rio Branco, about 180 miles south of Boa Vista. 7/10 overcast at 8000—visibility unlimited."

We began to see mountains now, first on the horizon to our left, and then to our right also, rising out of the flat llanos and jungle. For the jungle, as we approached Boa Vista, was only a narrow strip along the banks of the river. Beyond lay great stretches of open land—with occasional small lakes. By the time we reached Boa Vista (14:08 G.M.T.) we were almost in the foothills of the mountains, and started to cut across them to Trinidad.

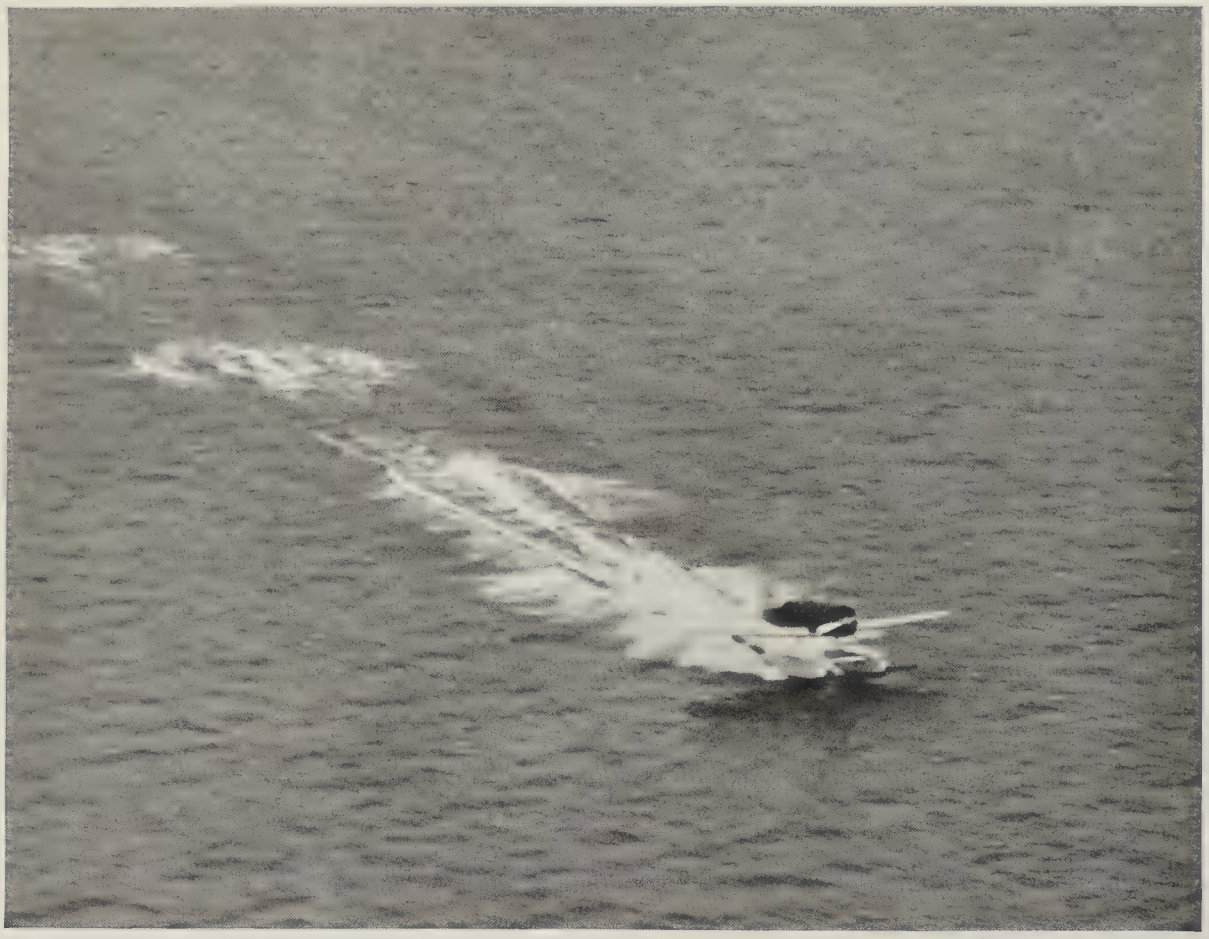
"14:40 G.M.T.—now following true course of 357° from Boa Vista."

We had left the river now, and were over the mountains, our hardest stretch. It did not look very formidable. The skies were clear except for a few puffy white clouds, which seemed to accentuate the appearance of good weather. The ridges, although steep, were separated with wide valleys and open stretches. One could see occasional huts by the streams. Every fifteen minutes we had radio contact with Port-of-Spain, Trinidad.

JUNGLES OF BRITISH GUIANA

When we passed over the ridges into British Guiana, the country became much wilder. The wide valleys and open stretches disappeared; the steep mountains were completely covered with jungle. I looked in vain for streams, and could not see any landmarks, except for Roraima, a high peak in the distance, wreathed in clouds.* These clouds, at first only a few in the sky, soon became numerous enough to cover all the tops of the mountains. Diving through them or flying above them, we saw very little of the jungle below.

* See "Through Brazil to the Summit of Roraima," by G. H. H. Tate, in the NATIONAL GEOGRAPHIC MAGAZINE for November 1930.



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TWO HOPS AND A SKIP—LIKE A FLAT STONE SKIMMING ACROSS THE WATER

December 19, 1933—Charles and Anne Lindbergh set *Tingmissartoq* down on "home" waters, five months and ten days from the day they headed toward northern skies. Two rippled pools trail off behind the plane.

But evidently the jungle saw us—or heard us, through the occasional thunderstorms. Long after we had returned home, a story drifted back from the native tribes in British Guiana. A jungle myth was born following our flight that afternoon. Once upon a time, the god became vexed and created a big mosquito, which he sent buzzing like the wind over the jungles. Just after it passed, a bolt of lightning struck the chief's house, ran down a pole, melted the head of his spear, and split his ceremonial seat in half.

At 16:00 G.M.T. the jungle green was broken by a straight white thread on our left—a long waterfall. The stream was flowing northeast, emptying into one of the rivers of British Guiana. We had passed the divide and were now gliding down over lower mountains.

"Posn—16:15—Passing Rio Cuyuni. 7/10 overcast—visibility unlimited."

Diving down through clouds and rainstorms we were soon over the flat jungles of the Orinoco Delta.

"Posn 17:30—Passing mouth of Orinoco—many rain squalls—otherwise 8/10 overcast and visibility unlimited."

VIOLENT SQUALLS FORCE LOW FLYING

As we crossed the water from Punta Baja to Trinidad, the squalls became much more violent, forcing us down to less than a hundred feet from the water. It looked black on all sides of us, with the visibility less than half a mile.

At 18:50 the storms lightened a little, and the south coast of Trinidad loomed up suddenly ahead. Feeling our way around to the west coast, through low clouds and rain, we landed at Port-of-Spain at 19:25 G.M.T. As I looked up at its familiar steep green hills, covered with tropical growth, at its harbor and town, at the Government House and its lovely gardens, I felt extremely happy, as though at home again. At last, I thought, here is a place I have been before.

From Trinidad our course lay over the circle of the Antilles, green volcanic moun-

Photograph from Keystone-Underwood

30,000 MILES, FOUR CONTINENTS, AROUND AN OCEAN, TWICE ACROSS—SAFELY HOME AGAIN

The propeller turns over for the last time as the pontoons nose up to the ramp at College Point, Long Island, the exact point of departure. Familiar ferryboats in the background ply across Flushing Bay in a December haze.

tains pushing their heads out of an azure sea, the Caribbean route we had flown three years before.

On December 14 we left Port-of-Spain for San Juan, Puerto Rico, where we landed at 18:32 G.M.T. After a night in Fortaleza, the old Spanish fort that is now the home of the Governor, we went on to the Dominican Republic, where we stopped for a night in San Pedro de Macorís. On December 16 we left San Pedro de Macorís at 11:31 G.M.T.; flew across the Dominican Republic and the coast of Haiti, detouring to pass over Christophe's Castle; and out across the Bahamas to Florida.

The white skyscrapers of Miami were visible about 18:02. We landed in the blue bay at 18:20 G.M.T.

We had about ten hours of flying from Miami to New York and broke the trip by stopping overnight at the Navy Yard in Charleston, as we had done many times before. On December 19 we left Charleston.

Six hours later the towers of Manhattan rose out of the haze.

Now we were over Flushing Bay. The black runways of North Beach, and the ramp we had left nearly six months before, were below us.

The ferryboats were still cutting their tracks in the water. Except for the gray, wintry look of the landscape, everything was the same, only—we had flown around the North Atlantic.

As we circled to land, I tried to hold on to the trip, now slipping by me, turning over in my mind the pictures, fingering them with pleasure like lucky pieces in my pocket: the white peaks of Greenland, a wall against the sky; the view from Governor Rasmussen's window; white butterflies on the bay at Copenhagen; the gray walls of Visby, looking out to sea; the volcanic slopes of Terceira, rising into clouds; the lights of Bathurst below us in the dark; miles and miles and miles of ocean; and that great serpent, the Amazon, stealing through the jungle.

"Landed Flushing Bay 19:37 G.M.T., December 19, 1933."

Photograph from Publishers' Photo Service

THE BANNER OF EACH KNIGHT OF THE BATH FLIES ABOVE HIS STALL IN WESTMINSTER ABBEY

In this Chapel of Henry VII, Knights of the Bath are installed with medieval pomp and ceremony. Below the stalls are seats, carved with their coats of arms, for the gentlemen who attend the knights as their esquires. Kings and queens, including Mary Queen of Scots, lie buried here.

FLAGS OF THE WORLD

By Gilbert Grosvenor and William J. Showalter

THE years since the World War have witnessed more changes in the flags of civilization than any other period of like duration in the history of humanity.

Out of the fallen empires of that greatest war of all times have arisen kingdoms, republics, colonies, and mandated territories.

Such ancient countries as Afghanistan and China have adopted new flags, while recent-born Manchutikuo has advanced a claim to a place in the family of nations and established a flag in accordance with that claim.

Even in such settled governments as those of the United States and the British Empire there have been many changes in the flags secondary to Old Glory in the one and to the Union Flag in the other.

Practically all of the United States military flags that shared the battlefields with the National Standard, whether colors of infantry regiments, standards of mounted troops, or the command flags of ranking officers, have joined the ranks of the obsolete. The War Department, wishing to have its whole series of flags designed in harmony and in keeping with the finest standards of heraldry, has almost entirely remade that part of the Army Regulations prescribing the designs and colors of the Army's flags.

MANY STATE FLAGS CHANGED

Fourteen States of the Union have changed their flags entirely, by legislative action; in eighteen other States the vagaries of embroidering designs upon flags have left their imprint in such a way as to create change by usage.

In the British Empire, the Union of South Africa and the Irish Free State have created their own national flags; while in all of the mandated territories and some of the old possessions, such as Nova Scotia, new badges have been approved. These badges are worn at the intersection of the crosses on the Union Flag (326) and in circles in the fly of the Blue Ensign (329) and the Red Ensign (328).

The flags and pennants of the International Code (525-564) also were redesigned and the changes put into effect on January 1, 1934. This group of flags and pennants was developed to enable all nations to communicate with one another on the high seas. As used for many years, some of the letters of the alphabet were represented by pennants and others by square flags, while all numbers were expressed by pennants. In order to overcome possible confusion, the newly revised code makes all flags representing letters of the alphabet oblong and all numerals pennant-shaped.

It has been said that flags were divinely ordained; that when Jehovah made His covenant with mankind that all flesh should never again be destroyed by a flood, He sealed the pledge by unfurling across the heavens the great banner of the ages—the rainbow itself.

STANDARDS ARE HEADINGS IN CHAPTERS OF HISTORY

From that time forward men in turn have lifted up standards, emblems, and colors around which they have kindled their fires of patriotism, developed their sense of loyalty to one another, and bound themselves together with ties of nationality.

Explorers have discovered on the monuments and in the tombs of ancient Egypt carvings and paintings depicting troops in formation with their standards uplifted and their banners streaming.

The people of Israel had their standards. We read in *Numbers:* "And the Lord spake unto Moses and unto Aaron, saying, Every man of the Children of Israel shall pitch (his tent) by his own standard with the ensign of their father's house."

As far back as 800 B. C. the Persians revolted against the tyranny of a despotic ruler. It was a good blacksmith by the name of Koah who led the cause and his apron became the standard of the revolt.

At the time of Cyrus the Persians used a white flag on which was a golden eagle.

The Roman Republic borrowed its silver eagle, holding in its talons the thunderbolts of Jove, from the Etruscans. Augustus lifted high a globe to commemorate his conquest of the earth. Constantine adopted the Cross to signalize his vision.

The early Greeks had a piece of armor on a spear; the Athenians used the olive and the owl as their emblem, and the Thebans lifted aloft a sphinx.

The efforts of the people of America to express their sentiments in flags constitute one of the romances of our history.

As the rising tide of resentment against British rule swept the Colonies, the faith of the people and their attitudes burgeoned forth on their flags. New England's protest was against the illegal acts of the British Ministry. It believed those acts would be repudiated by the King when he realized the injustice being done to his subjects in the Colonies. Therefore, Massachusetts petitioned the King to restore her rights, opening her statement of grievances with the phrase "Appealing to Heaven for the justice of our Cause." The expression caught the imagination of the people; the pine tree became their symbol and "An Appeal to Heaven" their motto (244).

Virginia-born George Washington complimented the New England spirit by suggesting the pine-tree flag and its motto for his cruisers (244), a series of schooners transferred from the merchant fleet to aid the army around Boston.

The Southern Colonies were in a mood of defiance rather than of appeal to God and Justice, and the rattlesnake became the expression of their attitude toward the home government. "Don't Tread on Me" was the warning command on most of the rattlesnake flags (253-256-262).

But as war stepped in and drove peace away, most of the leaders hoped to be able to show the King that theirs was not a war on him but a war only against what they considered the unlawful acts of the Ministry.

General Washington himself was careful to emphasize in all his early utterances as Commander-in-Chief that it was a war against the Ministry and not against the Sovereign.

Deep concern, therefore, was felt that a flag should be made that would proclaim at once loyalty to the Crown and resentment against the Ministry.

WASHINGTON WANTED A SINGLE FLAG

When General Washington took command of the Continental Army at Cambridge, he found that the divided loyalties of many flags made it essential to a hope of victory that the colonial units under him should be forged into one organization with a united outlook and continental loyalty. His orders, reports, and letters from that time forward contained many references to the difficulties encountered in building up an army that would acknowledge a single flag, and in combating the wranglings and rivalries in his existing force. He reported to the Continental Congress that he found a wide-spread unwillingness of officers of one colony to accept service with troops of another.

General Washington looked forward with eagerness to the first day of January, 1776, for it was on that day that his old army, with all of its conflicts, was to pass out of existence, and the new one, which he hoped would be free of the weaknesses of its predecessor, was to come into being.

But the last month preceding the transformation was one of utter anxiety for the Commander-in-Chief. On November 28, 1775, he wrote his military secretary that he "should not be at all surprised at any disaster that may happen," and added, "Could I have foreseen what I have, and am likely to experience, no consideration upon earth should have induced me to accept this command. A regiment or any subordinate department would have been accompanied with ten times the satisfaction, and perhaps the honor."

THE GRAND UNION FLAG

There was, however, much hard work included in this period of anxiety. Among the things to be done was to provide a flag which should at once be expressive of the union of the Thirteen Colonies in a single purpose and of the hope of those Colonies that reconciliation still remained possible. The Grand Union Flag (251), with its old British jack in the canton and its thirteen red and white stripes for its fly, was the outcome of the efforts made to find such a banner.

Historians have searched in vain for the slightest inkling of its designer or the authority under which it was established. Some have represented that a Congress Committee which visited Boston considered and authorized it, but a thorough search of the reports of this committee and the correspondence of those who constituted it fails to reveal any action or consideration by this committee.

Our first view of this flag was when it was hoisted aboard the *Alfred*, the flagship of the Congress Navy, lying in the Delaware River on December 3, 1775.

We get the fact of this significant event from no less an authority than John Paul Jones himself. He was at that time the senior lieutenant of the American Navy and was attached to the *Alfred*, the flagship of the fleet, his position corresponding to that

Photograph by Ewing Galloway

"I PLEDGE ALLEGIANCE TO MY FLAG AND TO THE REPUBLIC FOR WHICH IT STANDS"

Each week boys and girls of many schools throughout the United States pause to pay patriotic tribute to the Stars and Stripes. While they stand at salute, in this ceremony in Evander Childs High School, New York, pupils recite the famous pledge which was prepared by the American Flag Association.

of executive officer in the Navy to-day. In a letter to Robert Morris, Jones declared: "It was my fortune, as the senior of the Lieutenants, to hoist *myself* the Flag of America the first time it was displayed. Though this was but a slight Circumstance, yet I feel for its Honor, more than I think I should have done, if it had not happened."

Jones failed to give the date of that raising of the flag, but not so a loyalist reporting to the Earl of Dartmouth. Writing on December 20, 1775, the Earl's correspondent advises: "An admiral is appointed, a court established, and the 3d instant, the Continental flag on board the *Black Prince** opposite Philadelphia was hoisted." On December 12, a British spy at Philadelphia reported that "the commodore who commands this fleet comes from Rhode Island, his name is Hopkins."

On January 4, 1776, the British Intelligence Service sent a dispatch from Philadelphia, saying: "This day about one o'clock sailed the *Alfred* and the ship *Columbus* with two brigs . . . Hopkins commands

* The correspondent had not learned of its being rechristened the *Alfred*.

Photograph by Ewing Galloway

BANNERS OF THE 48 STATES EXHIBITED AT RICHMOND

This colorful display of State flags was held on the grounds of the Virginia War Memorial Carillon. The old flag of Vermont, with its 8-pointed star and red stripes (lower right), has been discarded (see No. 204), while the flag of Wyoming (inner circle, lower left) now has the head of the buffalo turned toward the staff, the point of honor (see No. 209).

the *Alfred*. She has yellow sides, her head the figure of a man, English colours, but more striped."

Thus out of the mouths of diverse witnesses are established not only the raising of the flag but also the date of the ceremony and the description of the ensign.

There has been much confusion about the flags which were displayed on the *Alfred* on that historic December day. The statement is often correctly made that Commodore Hopkins hoisted the Gadsden flag (253). To anyone acquainted with naval usage both then and now, this is no contradiction of the assertion made by John Paul Jones. Flagships display three flags when in port—the ensign flown at the stern, the flag of the commanding officer displayed at the mainmast if he is present, and the jack hoisted at the bow.

Commodore Hopkins was the commanding officer; therefore, his flag flew at the mainmast It was the Gadsden flag. The jack displayed was a small, nearly square, flag of alternate red and white stripes bearing a crawling snake with the legend "Don't Tread on Me" (252).

The navies of the world have always led in flag matters because international law has made ships that do not bear recognized ensigns liable to charges of piracy. It is on the basis of this fact that we may assume that the Grand Union Flag was of naval origin.

AN ARMY TRULY "CONTINENTAL"

The new Navy in front of Philadelphia barely had time to become accustomed to its new Continental colors before the long-awaited and planned-for day dawned at Boston when the old Colonial Army should be mustered out of existence and the new Continental one assigned to its trenches. Washington rejoiced that he had come

Official Photograph, U. S. Army Signal Corps

MEMORIAL DAY SERVICES IN HONOR OF AMERICA'S UNKNOWN SOLDIER

Few spots in all the United States witness so constant a procession of pious pilgrimages as this simple tomb in Arlington National Cemetery. Wreaths and flags of many lands are carried there every year to keep green the memory of all who died to uphold the flag of the United States.

at last into the command of an army "which in every point of view is entirely continental."

"We had hoisted the Union Flag (251) in compliment to the united colonies," Washington wrote in commenting on the events marking the birth of the new army. In a letter to the President of the Congress he declared: "It is not in the pages of History perhaps to furnish a case like ours. To maintain a post within musket shot of the Enemy for six months together (without powder) and at the same time to disband one Army and recruit another within that distance of twenty odd British regiments, is more than probably ever was attempted."

It has often been urged that the Grand Union Flag (251) was not raised at Cambridge but at Prospect Hill, in Somerville. However, a study of Washington's general orders shows that the Laboratory on Harvard Common in Cambridge shared with Prospect Hill the glory of being sites from which the flag was flown. Thus we are saved the necessity of believing that the principal post for the display of the Grand Union Flag was entirely outside the headquarters of the Commander-in-Chief and within the boundaries of one of his corps commanders, and are permitted to believe both Cambridge and Somerville shared the honor of the first display of the Grand Union Flag on the day the national army was born.

When General Washington shifted the scenes of the early Revolutionary struggle from Boston to New York by forcing the British to evacuate the former, he made July 9 another gala occasion. In his general orders for the day he recited that "The Hon. The Continental Congress, impelled by the dictates of duty, policy and necessity, having been pleased to dissolve the Connection which subsisted between this Country, and Great Britain, and to declare the United Colonies of North America free and independent States: The several brigades are to be drawn up this evening on their respective Parades, at Six OClock, when

Photograph from Keystone-Underwood

KING IBN SAUD'S ARMY CARRIED THIS FLAG IN ITS DESERT CONQUESTS

On a green field is the white Arabic inscription, "There is no god but God, and Mohammed is the Prophet of God." Below the inscription is a white sword. When the powerful King of Saudi Arabia visited Germany two years ago, this flag was broken out in his honor by the officials of Tempelhof, Berlin's huge airport.

the declaration of Congress, shewing the grounds and reasons of this measure, is to be read with an audible voice.

"The General hopes this important Event will serve as a fresh incentive to every officer, and soldier, to act with Fidelity and Courage, as knowing that now the peace and safety of his Country depends (under God) solely on the success of our arms."

After the reading of the Declaration, the Grand Union Flag (251) was raised over his fortifications and headquarters at what is now the Battery in New York. Ambrose Searle, confidential secretary of Admiral Lord Howe, a few days later wrote of the American troops:

"They have set up their standard in the fort upon the southern end of the town. Their colours are thirteen stripes of red and white alternating, with the union canton in the corner."

We may follow the Grand Union Flag over the seas for many months. On November 16, 1776, the *Andrea Doria* sailing under it saluted the Dutch flag and received a Dutch salute in return. In September, 1776, the brig *Reprisal* sailed from Philadelphia for France, carrying the Grand Union Flag as her ensign and Benjamin Franklin, newly appointed minister to France, as her most distinguished passenger. It was also the Grand Union Flag which Benedict Arnold carried on the *Royal Savage* in his Lake Champlain expedition.

THE BIRTH OF THE STARS AND STRIPES

How long the Grand Union Flag was flown has never been definitely established, but the official records of the Navy fail to show that any other ensign was in use until after the resolution creating the Stars and Stripes was adopted by the Congress. It was not until June 14, 1777, nearly a full year after the Declaration of Independence, that the Continental Congress took action substituting the Stars and Stripes for the Grand Union Flag. The records are entirely silent regarding the author of the resolution. The only hint we have as to who sponsored it is the fact that the resolution stands sandwiched in between a group of other resolutions clearly of marine import and that it therefore probably came from the Marine Committee.

The difficulties involved in presenting a work on the flags of the world that is absolutely up-to-date at the moment of its appearance are manifold. For instance, at the time the flag plates had to go to press, the future of the Saar Basin Territory faced the doubts of a plebiscite, and no one could say whether the existing flag (with its three horizontal bars, upper and lower blue and middle white) would continue to represent the Saar or whether it would give place to the French or German flag.

SWIFT CHANGES OF GEOGRAPHY REFLECTED IN FLAGS

Likewise, no one at that time could predict what the fortunes of war would bring in the land of Arabia, with its divers flags of uncertain tenure. Ibn Saud, after having been proclaimed King of Hejaz in 1926 and King of the Nejd in 1927, established himself as King of Saudi Arabia. He has since continued his career of conquest. His flag, illustrated on page 344, is said to have been designed by his grandfather about a century ago. The field is green and the inscription and keen-edged scimitar are in white.

The Kingdom of Manchutikuo came into being just in time to permit a flag (491) to find its proper place in our plates.

Even at home there were difficulties. The Department of the Interior holds that the stars on the flag of the Secretary of the Interior refer to bureaus and not to the rank of the head of the Department. Therefore, every time there is a shift of bureaus involving the Department of the Interior, the flag must be changed accordingly. The result was that the flag had to be changed three times during the process of making up page 347. After the plates were arranged, the Bureau of Insular Affairs was transferred from the War Department to the Department of the Interior, and it remains a question whether the chief of the bureau will take his flag (37) with him or whether he will have a flag in his bureau's new affiliation.

EXTENSIVE RESEARCH REQUIRED TO TRACE OUR FLAG'S HISTORY

The research involved in the preparation of this Flag Number represents six months of unremitting study and checking of facts.

Believing that one of the most regrettable gaps in our patriotic literature is the absence of authoritative data on the origin of both the Grand Union Flag (251) and the Stars and Stripes, the record was reëxamined to see whether the historians might not have overlooked some item which would clarify the situation. All the published proceedings of the Continental Congress were restudied; the Revolutionary records of the Navy were recanvassed; the historical archives of the several Colonies were searched again; the diaries and correspondence of those who in committees or elsewhere might have had some hand in bringing the two flags into existence were resurveyed; the correspondence and military orders of General Washington were scrutinized once more.

But the historians had turned and examined every stone, and the only hope that remains of finding new contemporary light upon the origin of these flags lies in some unknown attic among old records that have been lost to human ken.

One question the research did definitely answer was the date when that degree of unanimity in the Continental Congress was attained which made the Declaration of Independence and the adoption of an Independence Flag possible.

That unanimity had not been reached on May 31, 1776. On that date General Washington advised his brother Augustine that whole delegations in the Congress were still hopeful of reconciliation with England—"still feeding on the dainty food of reconciliation," he quaintly phrased the situation.

It was not until the British plan to take New York and the surrounding country became apparent that all hope of reconciliation was abandoned and the Colonies were ready to transform their war against the British Ministry into one for independence.

THE GEOGRAPHIC'S FIRST FLAG NUMBER

The first Flag Number of the National Geographic Magazine, issued in 1917, when America was well launched in the World War, was widely hailed upon its appearance. It included the flags of all nations of that time and also the major flags flown when Thomas Jefferson was President and when Christopher Columbus discovered America. Likewise, it included the code flags of our own Navy and those of international usage, making the most comprehensive presentation of the flags of the world then current and historical ever published.

President Woodrow Wilson joined with his Secretary of War, Newton D. Baker, and his Secretary of the Navy, Josephus

Daniels, in hailing the Flag Number as a distinct contribution to the morale of America as it marched on to the victory that ultimately crowned the arms of the Allies.

Librarians everywhere declare that THE GEOGRAPHIC 1917 Flag Number from the date of its appearance to the present time has constituted the most consulted work on the subject of flags on their shelves.

The high mortality of the flags of the world since 1917 and the high birthrate of new banners since that date have made necessary an entire new series of flag plates. Yet so accurate were the researches of Lieut. Comdr. (now Captain) Byron McCandless, the co-author of that Flag Number, upon the history of the American Flag that seventeen years before the critical eyes of millions of readers have not served to reveal a single change that should be made in the story of the Stars and Stripes as therein presented. On the other hand, new facts have come to light confirming the details of that story.

WHAT THE FLAG COLOR PLATES SHOW

It will be noted that pages 347, 350, 351, 354, 355, 358, 359, 362, 363, 366, and 367 are devoted entirely to current American flags, with those of the President, the members of his Cabinet, the General of the Armies, the United States Military Academy, and the United States Naval Academy sharing page 347 with the National Flag.

Pages 355, 358, 359, 362, 363, and 366, inclusive, show the flags of the 48 States, which are arranged alphabetically rather than according to the order of their admission to the Union.

Pages 370 and 371 present the historical flags of the Americas, including those under which the New World was explored and ruled prior to the Revolution. Pages 374 and 375 show the flags and badges of the British Empire.

The flags displayed on pages 378, 379, 382, and 383, inclusive, are those of the countries of the world outside of the United States and the British Empire. They are arranged in alphabetical order except where they are dependencies of other countries, as in the case of Chosen (485), formerly Korea, now an integral part of Japan.

On page 386 will be found the American Yacht Flags, International Code Flags and Pennants, and Code Signals.

Page 387 shows a series of Marine Signals and a group of important 18th-century flags.

Pages 390 and 391 show the flags and funnels of leading steamship lines and the rank flags of the world's major navies. Page 394 is devoted to the military and naval aircraft markings of those countries which maintain air establishments.

The Society acknowledges its deep indebtedness to Mr. A. E. Du Bois, the flag authority of the Quartermaster General's Office, for his fine helpfulness in the reproduction of the flags of the United States Army; to Lieut. Comdr. John W. Roper, of the Code and Signals Section of the Navy, for his splendid assistance in reproducing the other flags; to Mr. Herbert J. Pitt, of London, one of the world's leading authorities on flags, for his generous aid and guidance in securing the latest possible data on the flags of foreign nations.

FLAGS OF THE FEDERAL GOVERNMENT

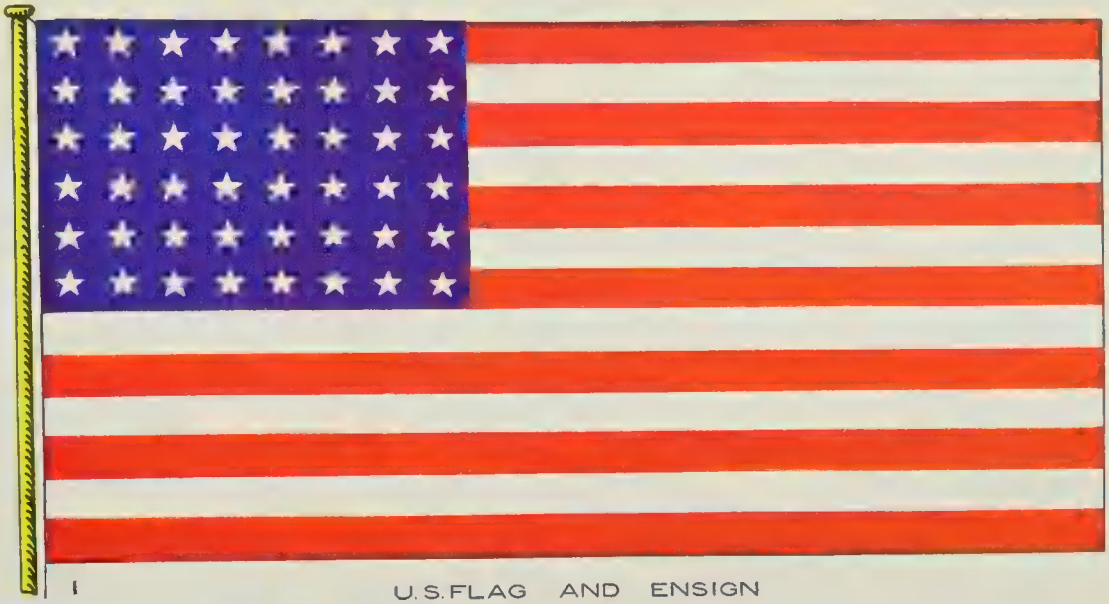
1. UNITED STATES FLAG AND ENSIGN.—It was not until July 4, 1912, that the United States Flag received its finishing touches. That year marked the emplacement of the two additional stars which represent Arizona and New Mexico. The Artillery did not carry the Stars and Stripes until 1834, the Infantry until 1841, and the Cavalry until 1895.

2. PRESIDENT'S COLORS—The colors and flag of the President of the United States are used respectively on land and sea. The coat of arms on the colors and flag is a reproduction of that on the President's Seal.

3. GREAT SEAL OF THE UNITED STATES.—This seal was adopted by the Continental Congress on June 20, 1782. The design on the obverse side is the one illustrated. That on the reverse side never has been cut and therefore never used. At the present time the seal is affixed only to important commissions, treaties, and the like, which bear the President's signature.

4. SEAL OF THE PRESIDENT.—The personal seal of the President is seen not only on his colors and flag but also in bronze on the floor of the entrance corridor of the White House. This is an impression seal and has no prescribed colors.

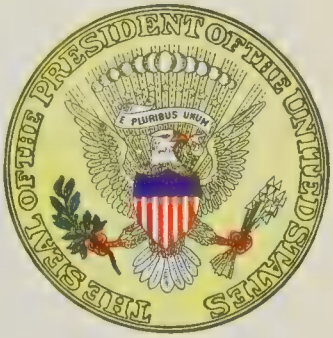
5. SECRETARY OF STATE.—The flag of the Secretary of State has the national coat of arms upon it and carries four stars. Until recently it had only two stars. But when Secretary



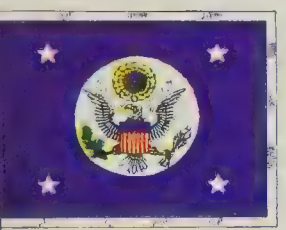
1 U.S. FLAG AND ENSIGN

3 GREAT SEAL- U.S.

2 PRESIDENT'S COLORS

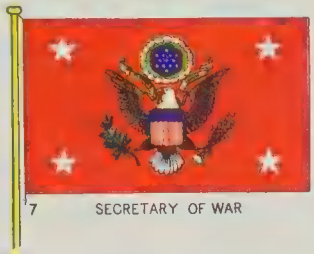


4 PRESIDENT'S SEAL

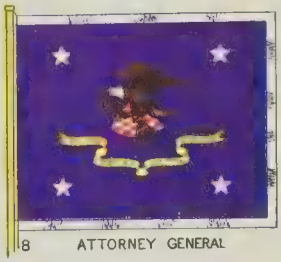


5 SECRETARY OF STATE

6 SECRETARY OF TREASURY



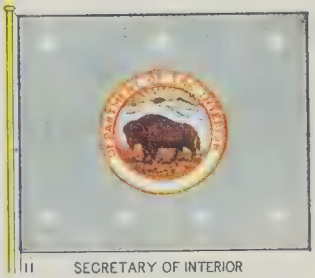
7 SECRETARY OF WAR



8 ATTORNEY GENERAL

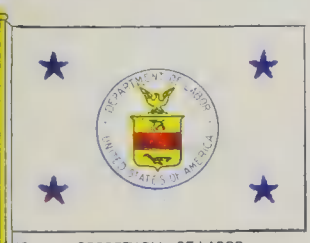
9 POSTMASTER GENERAL

10 SECRETARY OF THE NAVY



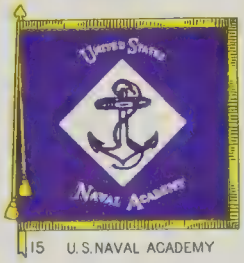
11 SECRETARY OF INTERIOR

12 SECRETARY OF COMMERCE

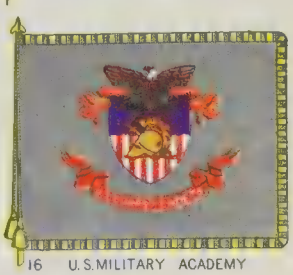


13 SECRETARY OF LABOR

14 GENERAL OF THE ARMIES



15 U.S. NAVAL ACADEMY



16 U.S. MILITARY ACADEMY

FLAGS OF THE UNITED STATES

Hull went to the Montevideo Congress, he had it redesigned to embody the regulation four stars in the flag of ranking civilian officials. In the Army the four stars of a General are distributed in a straight line across the fly of the flag. In the Navy the four stars of an Admiral are distributed as if placed at the angles of a diamond (see 104).

6. Secretary of Treasury.—The flag of the Secretary of the Treasury was designed before it became the practice to give ranking civilian officials four stars placed in the respective corners of the flag. His flag therefore carries 13 stars, representing the Thirteen Original States.

7. Secretary of War.—The flag of the Secretary of War carries the United States coat of arms and the four stars of the ranking civilian officials of the Government.

8. Attorney General.—The flag of the Attorney General is one of the newest, having been only recently designed and used. The inscription is *Qui Pro Domina Justitia Sequitur* (He who seeks justice for the people).

9. Postmaster General.—The flag of the Postmaster General is one of the latest additions to the Cabinet series, and its design commemorates the era of the Pony Express rider.

10. Secretary of the Navy.—With its white anchors and stars on a blue field, the flag of the Secretary of the Navy is the most frequently flown of all the Cabinet flags.

11. Secretary of Interior.—The Secretary of the Interior departs from the 4-star usage in his flag and uses instead stars that indicate the number of bureaus in his Department.

12. Secretary of Commerce.—The Secretary of Commerce uses the device on the official seal of the Department as the particular insignia on his flag.

13. Secretary of Labor.—The device on the flag of the Secretary of Labor is taken from the seal of the Department of Labor.

14. General of the Armies.—This flag, now used by General Pershing, with its gold fringe, four stars, and spread eagle, is one of the most attractive of the newly designed flags of the War Department.

15. United States Naval Academy.—These colors are carried by the regiment of midshipmen along with the National Colors.

16. United States Military Academy.—The colors of the corps of cadets wear an escutcheon bearing the National Colors, upon which is placed the cap of Mars. The streamer carries the words "Duty, Honor, Country—West Point MDCCCII U.S.M.A."

17. General, Chief of Staff.—The colors of the Chief of Staff of the Army represent a striking departure from the usual by having their field made up of two triangles, the one white and the other red. In the Army, colors are carried by dismounted troops, and standards by mounted or motorized units. With colors, cords and tassels are used, but not with standards. The inscription is *E Pluribus Unum.*

18. Chemical Regiment Colors.—The colors and standards of regiments differ from one another as the arm or service varies. In the Regular Army a regiment having an approved coat of arms carries its own shield embroidered on the eagle's breast, the regimental motto on a scroll in the eagle's beak, and the regimental crest above the eagle's head. A regiment having an approved badge but no coat of arms will have the eagle's breast feathered, the regimental motto will be placed on the scroll in the eagle's beak, and the regimental badge will replace the crest above the eagle's head. The difference, therefore, in the flags from 18 to 29 inclusive (with the exception of 22 and 23, which are respectively the colors of the Reserve Officers' Training Corps and the Citizens' Military Training Camp) will be noted mainly in the color of their respective fields, the crests above the eagle's head, and the devices on their breasts. The motto of the First Chemical Regiment (18) is *Ago Ardorem Fumumque* (I rule the fire and smoke).

19. Coast Artillery Regiment.—The motto of the 64th Coast Artillery Regiment is "We aim high."

20. Engineers Regiment.—The Second Regiment of Engineers has for its motto *Ardeur et Tenacite* (Eagerness and tenacity).

21. Infantry Regiment.—The 140th Regiment of Infantry carries the motto *Siempre Listo* (Ever ready).

22. Reserve Officers' Training Corps.—Camp Color (see 18).

23. Citizens' Military Training Camp.—Camp Color (see 18).

24. Air Corps Group.—The Eleventh School Group of the Air Corps has for its motto *Audacia Scientia* (Boldness, skill).

25. Cavalry Regiment.—The motto carried by the 114th Cavalry Regiment is *Via Vi* (A way by force).

26. Field Artillery Regiment.—The 152nd Field Artillery Regiment has for its motto "On the Way."

27. Medical Regiment.—The 135th Medical Regiment's motto is *Auxilium Omnibus* (Aid for all).

28. Quartermaster Train.—The Forty-fifth Division Train of the Quartermaster Corps has for its motto "Peace and progress."

29. Signal Battalion.—The Fifty-first Signal Battalion has *Semper Constans* (Always constant) for its motto.

30. Tabard.—Tabards are banners of silk or other suitable material, attached to the crooks of bugles or trumpets by silk cords having acorns at each end.

31 to 52 inclusive.—With the exception of the flags of the Christian and Jewish Chaplains (32 and 33), and the Commission Pennant of War Department Vessels (34), all of this group

of flags are the automobile flags of the ranking officers of the several branches of the service. They are all flown from a staff of wood surmounted by an acorn-shaped head. With the exception of the flag of the Bureau of Insular Affairs (see page 345), they all bear the two stars of the Major General and the devices of their respective arms or services—the shield of the Adjutant General's Department, the propeller and wings of the Air Corps, the crossed sabers of the Cavalry, the benzol ring and crossed retorts of the Chemical Warfare Service, the cannon and projectile of the Coast Artillery, the castle of the Corps of Engineers, and the crossed field guns of the Field Artillery, etc. The inscription on the flag of the Major General, General Staff (44) is *E Pluribus Unum,* while that on the flag of the Inspector General (46) is *Droit et Avant* (Right and forward).

53. Harbor Defense Commander.—This flag is flown on a halyard by the officer in charge of the harbor defense.

54. Flag of the Chief Umpire at Maneuvers.—This flag is carried by the officer who has been designated to head those who determine the victors in war games.

55. Ambulances.—This is the flag of the Geneva Convention. As illustrated here, it is the Ambulance flag, but it is also flown over hospitals and hospital ships.

56. Veterinary Ambulances.—This flag is flown by veterinarians of the Army on their missions of mercy to heroic war horses.

57. Mine Planter.—The flag of a mine planter, with its interesting device, is flown from a halyard.

58. Army Transports.—This flag is flown by Army transports from a halyard. With slight changes it has witnessed the carrying of hundreds of thousands of Uncle Sam's soldiers and marines.

59. General Headquarters.—This flag of General Headquarters and 60, 61, 62, 63, 64, 65, 66, and 67 constitute the distinguishing flags of corps, corps areas, cavalry corps, cavalry divisions, infantry divisions, artillery brigades, cavalry brigades, and infantry brigades.

68 to 81 inclusive, Guidons of the Army.—Guidons prescribed for use by troops have colors corresponding in general to the colors of the arm or service to which they belong. As in the case of colors and standards, they are surmounted by spearheads, which formerly were used as emergency weapons by their bearers.

82. Marking Pennant.—This pennant is used to mark off areas such as parade grounds.

83. Coast Guard Ensign.—The badge on this ensign is surrounded by the motto *Semper Paratus—1790,* meaning "Always prepared." The Coast Guard Standard and the flag of the Coast Guard Commandant carry the same motto. In time of war the Coast Guard operates as a part of the United States Navy and uses the flags and pennants of the naval service.

84. Coast Guard Pennant.—This pennant is worn by Coast Guard cutters in commission during peace times.

85. Coast Guard Standard.—The Coast Guard Standard, with its spread eagle wearing the shield of the United States on its breast, has been somewhat revised from the eagle carried in the canton of the Coast Guard Ensign.

86. Coast Guard Anchorage Flag.—Cutters patrolling anchorage grounds of large harbors carry this flag at their jack staffs.

87. Coast Guard Commandant.—The flag of the Commandant of the Coast Guard has the two stars of a Rear Admiral and the insignia of the service.

88. Coast and Geodetic Survey.—It is under this flag that the Coast and Geodetic Survey charts the harbors and maps the seas for the guidance of shipping.

89. Coast and Geodetic Survey Pennant.—The pennant of the Coast and Geodetic Survey is flown at the mainmast while the vessel is in commission, that is, while it is in actual service.

90. Coast and Geodetic Survey Director.—The flag of the Director of the Coast and Geodetic Survey is distinguished by its white triangle.

91. Bureau of Fisheries.—The flag of the Bureau of Fisheries, with its red diamond and white fish, was adopted in 1896.

92. Commissioner of Fisheries.—The flag of the Commissioner of Fisheries dispenses with the red diamond and shows the white fish on the blue field.

93. United States Power Squadron.—Power boat squadrons counter the design of the Yacht Ensign in having blue perpendicular stripes where the Yacht Ensign has horizontal red stripes; the Yacht Ensign has a blue canton while the power boat squadrons have a canton of red.

94. Public Health Service.—The flag of the United States Public Health Service, with its field of international quarantine yellow and its device of the caduceus and the fouled anchor, was adopted in 1894.

95. United States Immigration Service.—The seal on this flag is that of the Department of Labor, to which the Immigration Service belongs.

96. United States Customs.—The United States Customs Flag is the same as the Coast Guard Ensign with the device of the Coast Guard Ensign omitted.

97. Bureau of Navigation.—The service flag of the Bureau of Navigation, with its white ship on a red disk amid a blue background, is flown by all vessels of the Navigation Service during daylight hours.

98, 99, 100, Bureau of Lighthouse Flags.—The common feature of the three flags of the

17 CHIEF OF STAFF

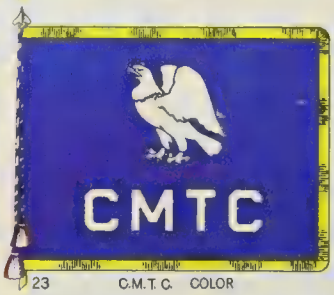
18 CHEMICAL REGT.

19 COAST ARTILLERY REGT.

20 ENGINEERS REGT

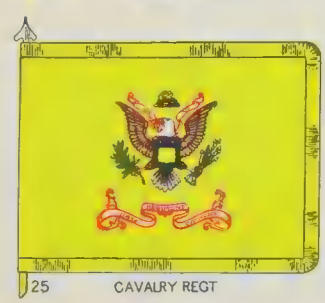
21 INFANTRY REGT.

22 R.O.T.C. CAMP COLOR



23 C.M.T.C. COLOR

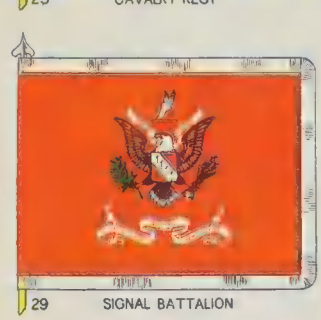
24 AIR CORPS GROUP


25 CAVALRY REGT

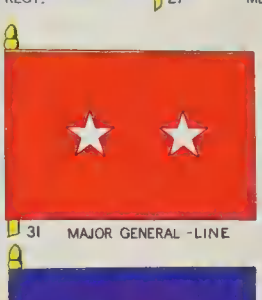
26 FIELD ARTILLERY REGT.

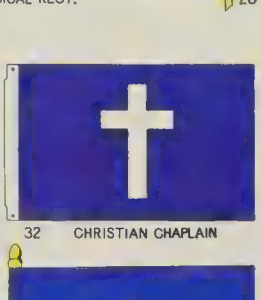
27 MEDICAL REGT.

28 QUARTERMASTER TRAIN

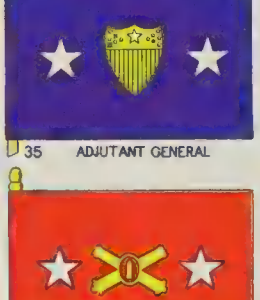

29 SIGNAL BATTALION

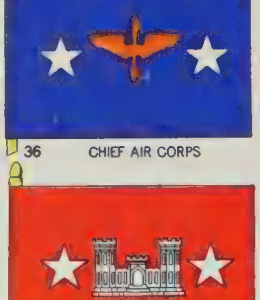
30 TABARD


31 MAJOR GENERAL - LINE

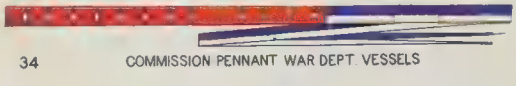

32 CHRISTIAN CHAPLAIN

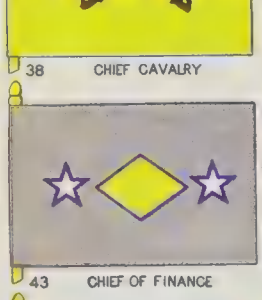
33 JEWISH CHAPLAIN

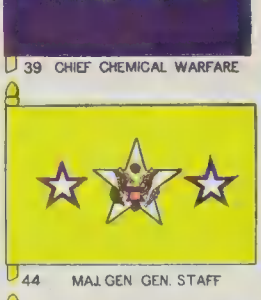

35 ADJUTANT GENERAL


36 CHIEF AIR CORPS

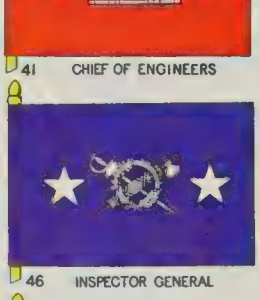
37 CHIEF BU. INSULAR AFFAIRS

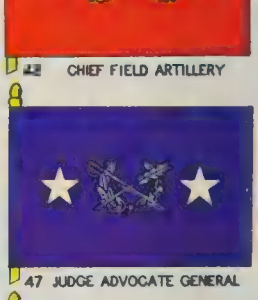

34 COMMISSION PENNANT WAR DEPT. VESSELS

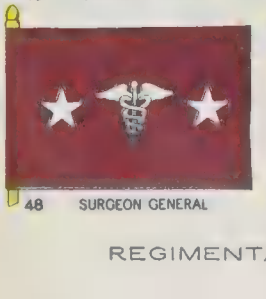

38 CHIEF CAVALRY

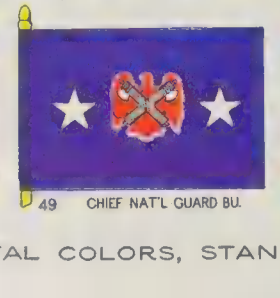

39 CHIEF CHEMICAL WARFARE

40 CHIEF COAST ARTILLERY

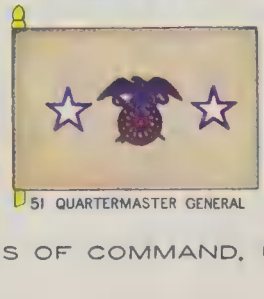

41 CHIEF OF ENGINEERS

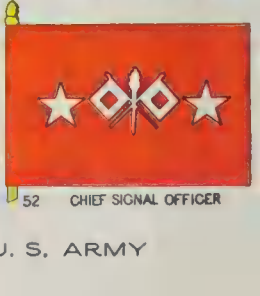

42 CHIEF FIELD ARTILLERY


43 CHIEF OF FINANCE


44 MAJ. GEN. GEN. STAFF

45 CHIEF OF INFANTRY


46 INSPECTOR GENERAL


47 JUDGE ADVOCATE GENERAL

48 SURGEON GENERAL

49 CHIEF NAT'L GUARD BU.

50 CHIEF OF ORDNANCE

51 QUARTERMASTER GENERAL

52 CHIEF SIGNAL OFFICER

REGIMENTAL COLORS, STANDARDS, AND FLAGS OF COMMAND, U. S. ARMY

DISTINGUISHING FLAGS AND GUIDONS

83 COAST GUARD ENSIGN
84 COAST GUARD PENNANT
85 COAST GUARD STANDARD
86 COAST GUARD ANCHORAGE
87 COAST GUARD COMMANDANT
88 COAST & GEODETIC SURVEY
89 C. & G. SURVEY PENNANT
90 C. & G. DIRECTOR
91 BUREAU OF FISHERIES
92 COMNR. OF FISHERIES
93 U.S. POWER SQUADRONS
94 PUBLIC HEALTH SERVICE
95 U.S. IMMIGRATION SERVICE
96 U.S. CUSTOMS
97 BUREAU OF NAVIGATION
98 BUREAU OF LIGHTHOUSES
99 COMNR. LIGHTHOUSES
100 INSP. LIGHTHOUSES
101 U.S. MAIL VESSELS
102 PAN AMERICAN UNION

FLAGS OF U. S. GOVERNMENT BUREAUS AND SERVICES

Bureau of Lighthouses is the lighthouse with its three windows and its lantern.

101. United States Mail Vessels.—This pennant is no longer required to be flown aboard United States mail vessels or vessels carrying United States mail, but many of them still keep it floating.

102. Pan American Union.—The flag of the Pan American Union is a pennant which was adopted in 1907. It embodies all the colors in the flags of the 21 republics.

103. Assistant Secretary of the Navy.—The flag of the Assistant Secretary of the Navy became the flag of the Assistant Secretary of the Navy for Air, but when that office was abolished it reverted to the Assistant Secretary of the Navy. Most of the assistant secretaries of the Government Departments use the flag of their respective chiefs with colors reversed—that is, the device and the stars take the color of the field of their chief's flag and the field of their flag takes the color of their chief's device.

104, 105, 106, 107.—These ranking flags of the United States Navy have the four stars of the Admiral, the three stars of the Vice Admiral, the two stars of the Rear Admiral, and the one star of the Commodore. The grade of Commodore has been abolished, and as there are only a few retired Commodores, the flag soon will pass completely from naval usage.

108. Broad Command Pennant.—This flag used to be that of the commander of a destroyer flotilla.

109. Burgee Command Pennant.—This pennant is flown at the after masthead of a ship or in the bow of a boat in which is embarked a regularly assigned Division Commander of a type of ship other than battleship or cruiser. The pennant of the commander of a destroyer or submarine division is surcharged with the number of the division in red Arabic numerals.

110. Senior Officer Present.—When naval vessels are together, with no flag officer present, the Senior Officer uses this triangular blue flag to signify that he has taken command of the group. The flag flies at the starboard main yardarm.

111, 112, 113. Naval District Force Commander.—Patrol Force Commanders fly this swallow-tailed pennant; Section Commanders under them use a smaller flag of the same type with Roman numerals on it (112). Each section in turn is set up in divisions and each Division Commander carries a triangular pennant with Arabic numerals on it (113).

114. Infantry Battalion Flag.—When the Navy lands men as infantry for shore duty, they carry this flag.

115. Artillery Battalion Flag.—Naval artillery landed for shore duty carries the red flag with a white diamond on which is imposed a red anchor.

116. Red Cross Flag.—This flag is flown from naval hospitals and hospital ships.

117. Church Pennant.—This pennant is flown whenever divine services are held aboard ship (see illustration, opposite page).

118. Battle Efficiency Pennant.—No banner in the American Navy is more earnestly contested for than this pennant, which is awarded annually to the ship making the best rating in battle efficiency.

119. Commission Pennant.—The Navy has latterly discarded the old 13-starred Commission Pennant and gives to its ships the 7-starred pennant instead. This pennant is flown at the mainmast as long as a ship is in commission, except when under command of an officer higher than the rank of captain, when the flag of command takes its place.

120. Quarantine Flag.—As an evidence of contagion aboard, this is the most unpopular of all flags in the American Navy. The same flag is used by commercial ships.

121. Merchant Marine Naval Reserve.—The flag of the United States Naval Reserve is displayed on ships which have been awarded certificates that they belong to the United States Naval Reserve.

122. Naval Reserve Yacht Pennant.—The yacht pennant of the Naval Reserve may be worn by those yachts which have become a part of the Reserve forces of the country.

123. Naval Militia Commission Pennant.—This pennant is carried by vessels of the Naval Militia at the mainmast while in commission, unless the commanding officer has a higher rank than captain.

124. Naval Militia Distinguishing Flag.—This flag is authorized to be flown from the foremasthead of vessels lent by the Navy, and actually maintained by a State, for the training of Naval Militia personnel, when such vessels are actually under the command of a Naval Militia officer.

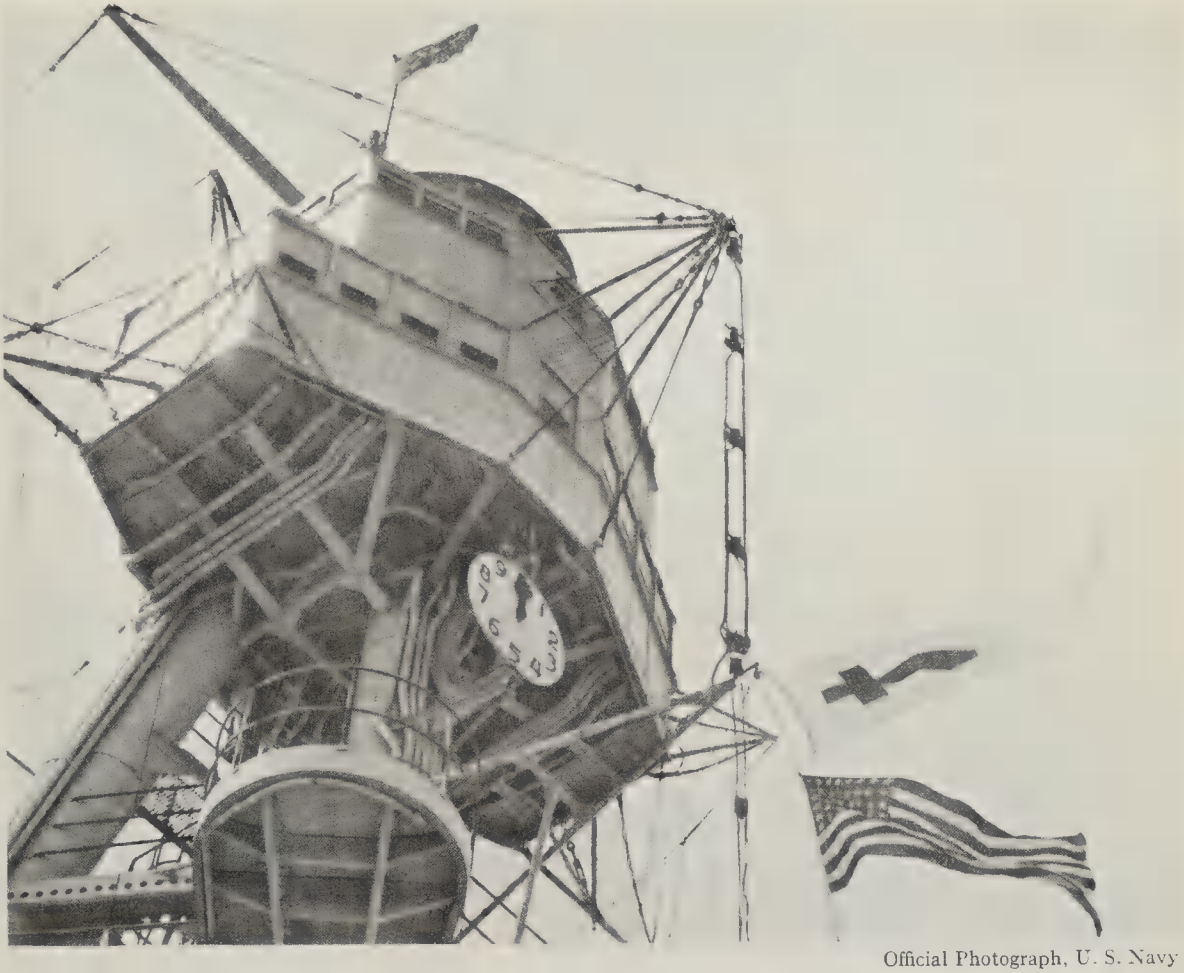
125. Consular Flag.—This flag is carried on ships when a consul is aboard.

126 to 149 inclusive.—These are signal flags of the United States Navy with their respective meanings set forth beneath them.

150. Marine Corps Standard.—The only existing standard of the Marine Corps is at the Marine Barracks in Washington. It bears the Corps' motto *Semper Fidelis* (Ever faithful).

151. Regimental Standard, Marine Corps.—With its blue field, red streamers, and eagle perched upon the top of the world, the Regimental Standard of the Marine Corps quickens the blood of admirers of the Marines everywhere. Only the new regiments fly this standard. The older regiments still keep the standards, slightly variant, that have gone with them to the ends of the earth.

152. Brigade Pennant, Marine Corps.—This pennant has a blue field and white lettering.



Official Photograph, U. S. Navy

ALL SAILORS KNOW FROM AFAR WHEN THE PRESIDENT WORSHIPS AT SEA

At the main truck of the Presidential ship flies the flag which proclaims his presence aboard. The church pennant, fluttering at the peak, is the only flag ever flown from the same hoist above the Stars and Stripes. It indicates the hour of divine service.

153. Post Commander Boat Pennant, Marine Corps.—This pennant has 13 stars next to the staff and the device of the Marine Corps on the fly.

154. Quartermaster Supply Depot and Train Pennant, Marine Corps.—It is under this flag that the Marine Corps moves its ammunition and the food which keeps the Marines in fighting trim wherever they go.

155. Guidon, Marine Corps. — The red guidon of the United States Marine Corps has moved with the Marines into many a stirring encounter.

156, 157, 158.—These are the post and boat flags and the auto tag of a Major General of the Marines.

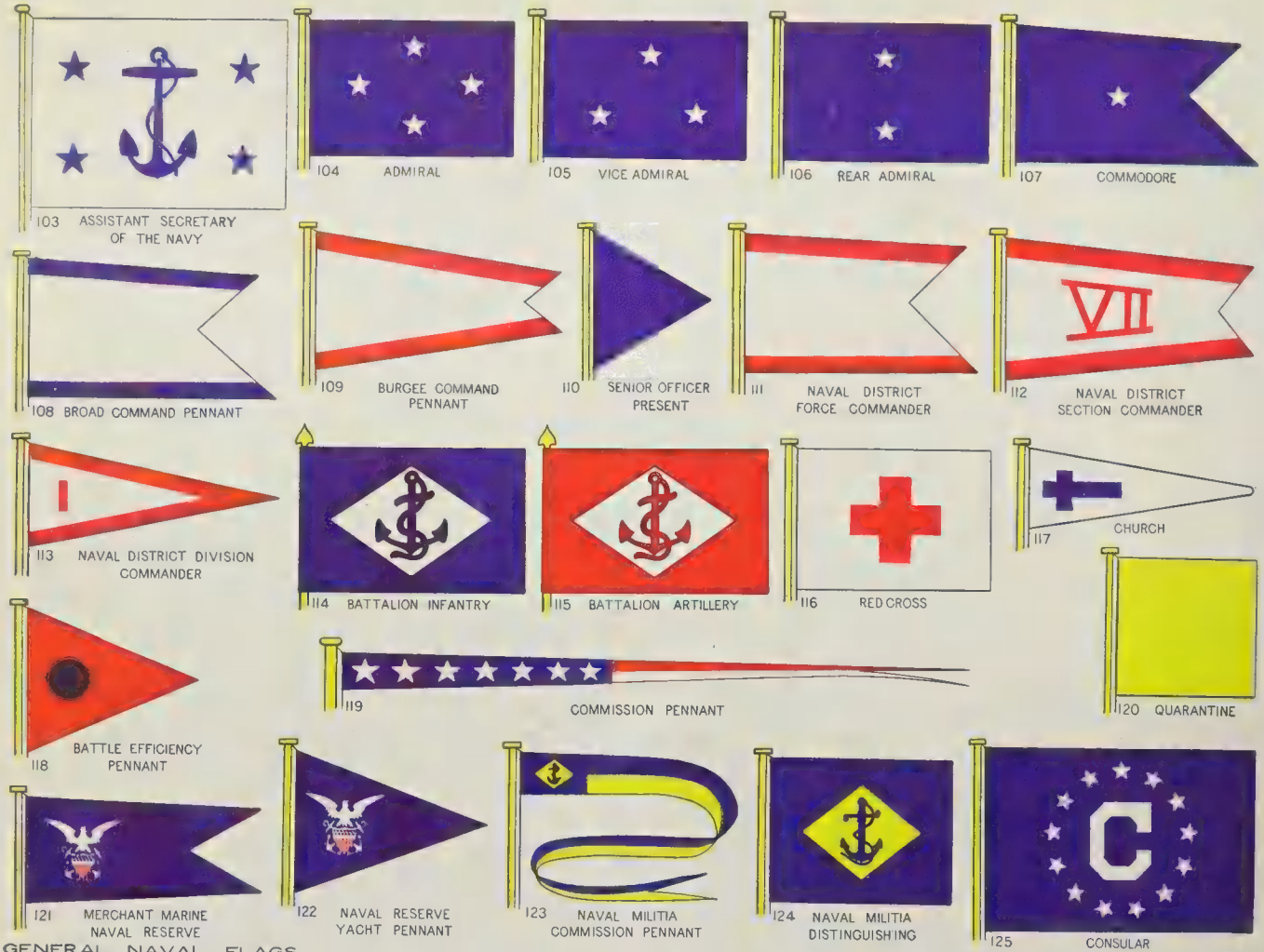
159, 160, 161. — These flags represent the post and boat flags and auto tag of a Brigadier General of the Marines.

FLAGS OF THE STATES, TERRITORIES, AND POSSESSIONS

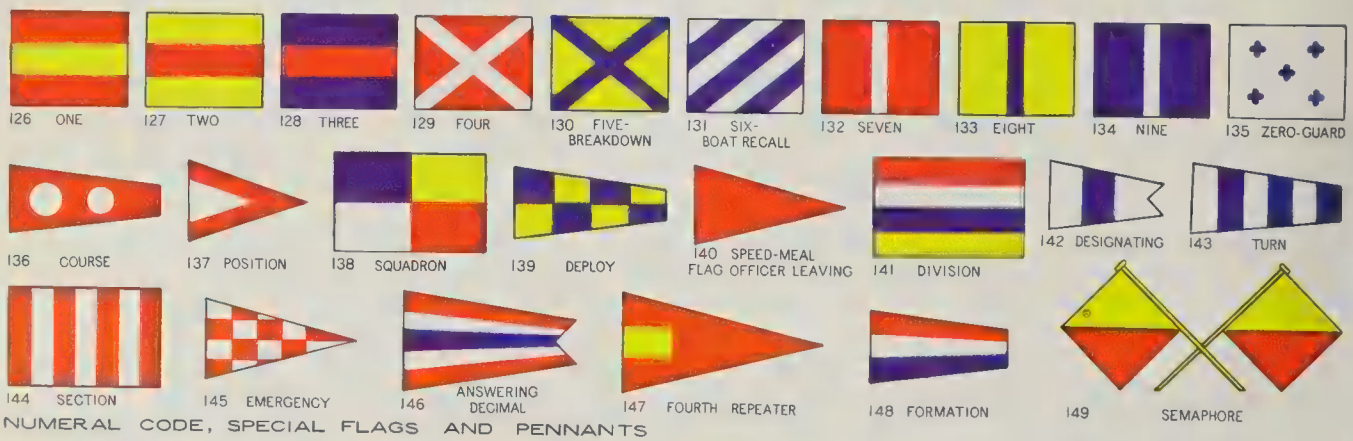
162. Alabama. — Colors for the State of Alabama were adopted by an act of February 16, 1895, which provides that the flag of the State shall be a crimson Cross of St. Andrew upon a field of white. The proper size is 51 inches square over all, with the arms of the St. Andrew's Cross 8½ inches wide.

163. Arizona.—A bill making the flag of the battleship *Arizona* the banner of the Commonwealth for which it is named was adopted in 1917. The 13 rays represent the setting sun, facing which is the copper-colored star of Arizona. The hoist of the flag is two thirds of the fly.

164. Arkansas.—The present flag of Arkansas was adopted by legislative action on April 10, 1924. The 25 white stars show that Arkansas was the 25th State admitted to the Union. The blue star above "Arkansas" is to commemorate the Confederacy; the three blue stars below typify the three nations of Spain, France, and the United States to which the State successively belonged. They also indicate that it was the third State carved out of the Louisiana Purchase. Of these three stars, "the twin stars parallel with each other typify that Arkansas and Michigan are twin States, having been admitted to the Union together on June 15, 1836."

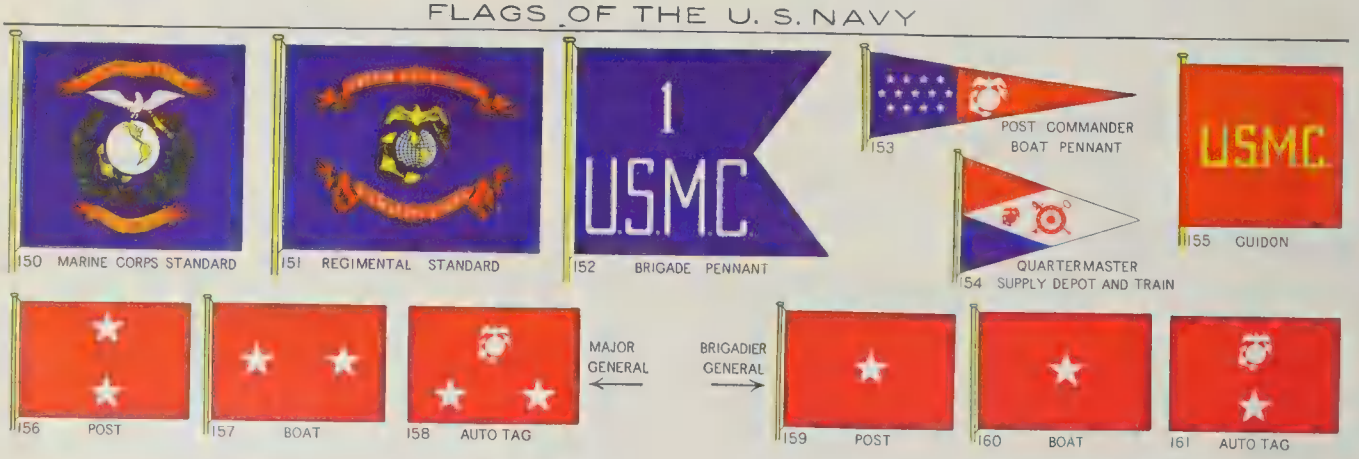


GENERAL NAVAL FLAGS

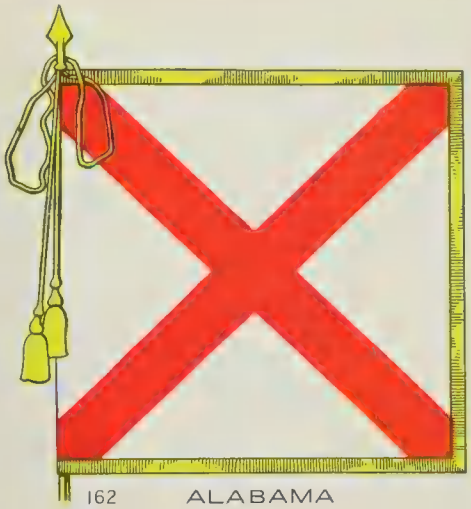


NUMERAL CODE, SPECIAL FLAGS AND PENNANTS

FLAGS OF THE U. S. NAVY



FLAGS OF THE U. S. MARINE CORPS



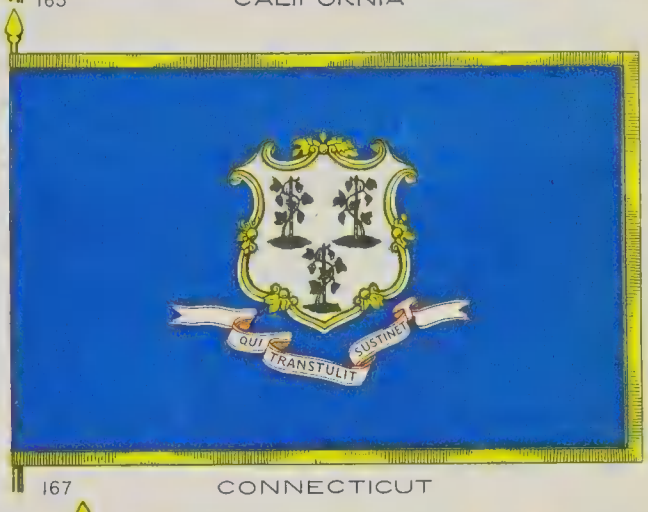
162 ALABAMA

163 ARIZONA

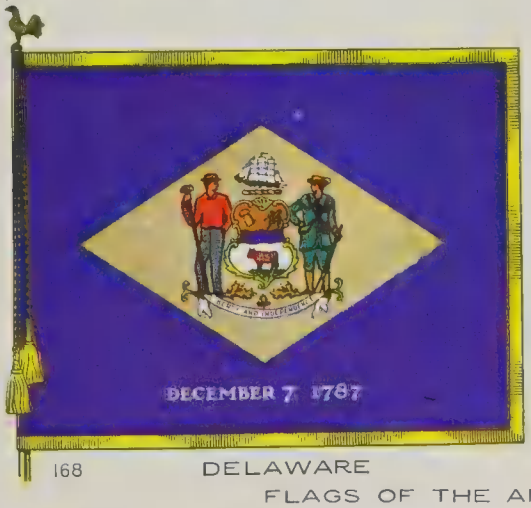
164 ARKANSAS

165 CALIFORNIA

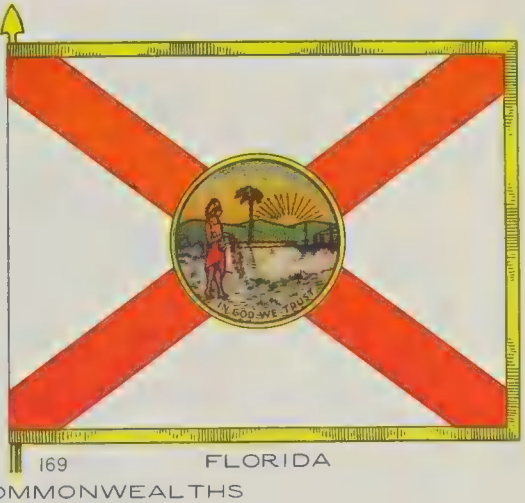
166 COLORADO



167 CONNECTICUT



168 DELAWARE



169 FLORIDA

FLAGS OF THE AMERICAN COMMONWEALTHS

165. California.—The Bear Flag was adopted by the California Legislature in 1911. This flag dates from the days of the California pioneers and commemorates the huge bear, the California grizzly, which is now extinct. The hoist of the flag equals two thirds of the fly. The red stripe at the bottom is one sixth of the fly.

166. Colorado.—The flag now used by the State of Colorado was adopted in 1911, although in 1929 a new description was approved by legislative action. The hoist of the flag is two thirds of the fly.

167. Connecticut.—Although in use prior to that time, the present State Flag of Connecticut was made official by an act of the legislature in 1897. The design in the center is the State seal, the three grapevines representing the three original settlements of Connecticut—Hartford, Windsor, and Wethersfield. The Latin inscription *Qui Transtulit Sustinet* is a survival of the Nutmeg State's colonial banner and, freely translated, means "He who brought us over sustains us." The hoist of the flag is approximately four fifths of the fly.

168. Delaware.—The official flag of Delaware was not adopted by legislative action but by a commission consisting of the State's President *pro tempore* of the Senate, the Speaker of the House of Representatives, and the Secretary of State, who devised the flag in 1914. The buff diamond bears the coat of arms of the State. The date refers to Delaware's entry into the Union.

169. Florida.—The present flag of the Everglade State dates from 1899. The State seal in the center of the flag was adopted by the Constitutional Convention in 1868. The hoist of the flag is three fourths of its fly.

170. Georgia.—The legislature of Georgia adopted the arrangement of the bars of the Georgia flag in 1879. In 1905 the coat of arms of the State was added. This law was reenacted in 1916. The word "Constitution" appears on the arch of the coat of arms; the three pillars are engraved with the words "Wisdom, Justice, Moderation" to represent the legislative, executive, and judicial branches of the State Government.

171. Idaho.—The State Flag of Idaho was created by legislative action in 1909. Idaho's laws forbid all military organizations within its boundaries from carrying any other flag or device than the National Flag and the flag of the Commonwealth. The coat of arms bears the legend *Esto Perpetua* (May she be perpetual). The hoist of the flag is approximately four fifths of the fly.

172. Illinois.—Authorization for Illinois' State Flag was given July 6, 1915. The seal used on the flag was adopted in 1819. The streamer in the eagle's mouth bears the motto "State Sovereignty—National Union."

173. Indiana.—Although the legislature of the State of Indiana declared in 1901 that its official banner should be the American Flag itself, it reconsidered this action in 1917 and adopted a State emblem. The torch represents Liberty and Enlightenment; the 13 stars in the outer circle, the Thirteen Original States; the five stars in the half circle below the torch, the States admitted prior to Indiana; the large star above the torch represents Indiana, the 19th State of the Union. The hoist of the flag is approximately four fifths of the fly.

174. Iowa.—The State Flag of Iowa as now used was authorized by legislative action on March 29, 1921. It is an adaptation of the design made at the time of the World War and accepted by the State Council of National Defense to be used by the State regiments. That "use of State flags was, however, rendered impossible by the policy of the War Department of assigning men to military units without regard to the State from which they came." The scroll in the eagle's beak contains the motto, "Our liberties we prize and our rights we will maintain."

175. Kansas.—The Kansas Legislature adopted a flag for the State on March 23, 1927. The State seal bears the motto *Ad Astra Per Aspera*, meaning, "To the stars through difficulties." The sunflower is the official flower of the State, and the wreath signifies the Louisiana Purchase. "The thirty-fourth star represents Kansas as the thirty-fourth State admitted to the Union." The hoist of the flag is approximately five eighths of the fly.

176. Kentucky.—The flag for the Blue Grass State was ratified by legislative action on March 26, 1918. The goldenrod is the State flower. The original seal of the State, as shown on the State monument at Frankfort, portrays two pioneers in hunters' garb shaking right hands, embracing, and standing on the verge of a precipice. But the engravers of the State have uniformly dressed the figures more to suit their ideals, with varying heraldic effect. The dimensions of the flag also vary.

177. Louisiana.—The State Flag of Louisiana is over a hundred years old, having become the unofficial flag about the time of the War of 1812. It was ratified as the official State flag on July 1, 1912.

178. Maine.—The flag of Maine was adopted by legislative action in 1909. The shield carries the word *Dirigo*, meaning, "I direct." The hoist of the flag is approximately four fifths of the fly. The fringe prescribed by law is two and one half inches wide.

179. Maryland.—In 1904, when Maryland's flag was adopted by legislative action, it was one of the oldest flags in use in the world. It was the flag of the Proprietary Government of Maryland generations before American independence was dreamed of and has continued

Photograph by Edwin L. Wisherd

MAKING STAR-SPANGLED BANNERS AT THE FLAG DEPOT, PHILADELPHIA

Girls fashion the bunting flags for the United States Army in this room on hundreds of machines, whose steady roar sounds like the hum of a mammoth beehive. Red and white stripes and blue fields are cut with a rotary knife; the stars are made in lots of fifty with a die stamp. While some women sew the stripes together, others stitch the stars on the blue fields, one star on each side in a single operation. Then fields and stripes are joined and the flag is completed.

in use from that time until the present. It represents the escutcheon of the paternal coat of arms of Lord Baltimore.

180. Massachusetts. — Legislative action of 1908 and further action taken in 1915 have combined to produce the present flag of the Commonwealth of Massachusetts. The coat of arms of the Commonwealth upon a white field, as shown in figure 180, is the obverse of the flag. The reverse shows a blue shield bearing a representation of a green pine tree upon a white field. The motto shown on the obverse of the flag is *Ense Petit Placidam Sub Libertate Quietem,* which may be translated as, "With the sword she seeks peace under liberty." No dimensions are prescribed by law, but the flag carried by the State troops has a hoist which is approximately four fifths of the fly.

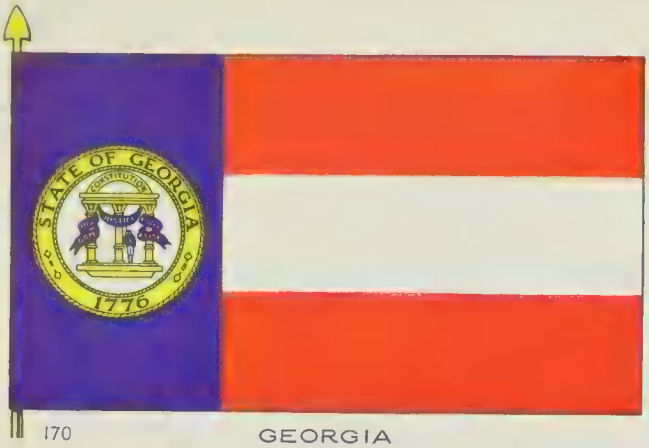
181. Michigan.—Legislative action on April 29, 1911, created the flag of Michigan. The coat of arms carries the motto *Si Quaeris Peninsulam Amoenam, Circumspice,* signifying: "If you seek a pleasant peninsula, look around you." The word *Tuebor* means "I will defend," a reference to the frontier position of the State of Michigan.

182. Minnesota.—The Minnesota State Flag was adopted on February 28, 1893. The other dates on the flag are 1819, the time of the settlement of Minnesota, and 1858, the year of the admission of Minnesota to the Union. The reverse of the flag is blue. The motto *L'Etoile du Nord* (The Star of the North) indicates the North Star State. The 19 yellow stars proclaim the fact that it was the 19th State admitted into the Union after the Original Thirteen.

183. Mississippi.—A committee to design a State Flag and seal was appointed by legislative action on February 5, 1894. The hoist of the flag is two thirds of its fly. The union square equals two thirds of the hoist.

184. Missouri.—Missouri formally adopted an official flag on March 22, 1913. The coat of arms carries the motto *Salus Populi Suprema Lex Esto,* signifying: "The welfare of the people is the supreme law." The hoist of the flag is seven twelfths of the fly.

185. Montana.—The State Flag of Montana was adopted by law in 1905, providing that it should be a copy of the flag borne by the First Montana Infantry, United States Volunteers, in the Spanish-American War, except that the device "First Montana Infantry, U. S. V.," should be omitted. The scroll on the seal carries the words *Oro y Plata,* which refers to the gold and silver found in the State.

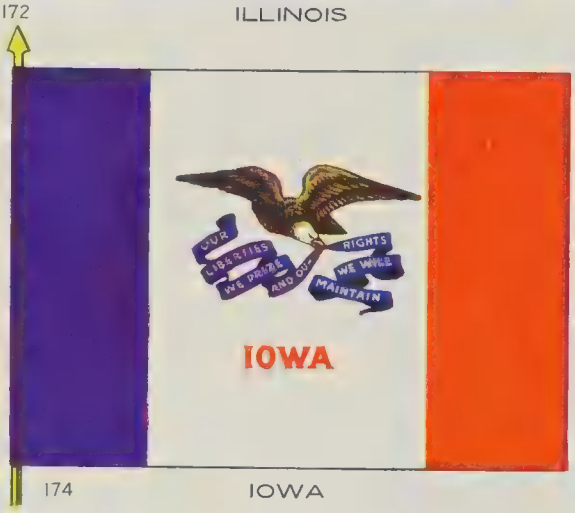


170 GEORGIA

171 IDAHO

172 ILLINOIS

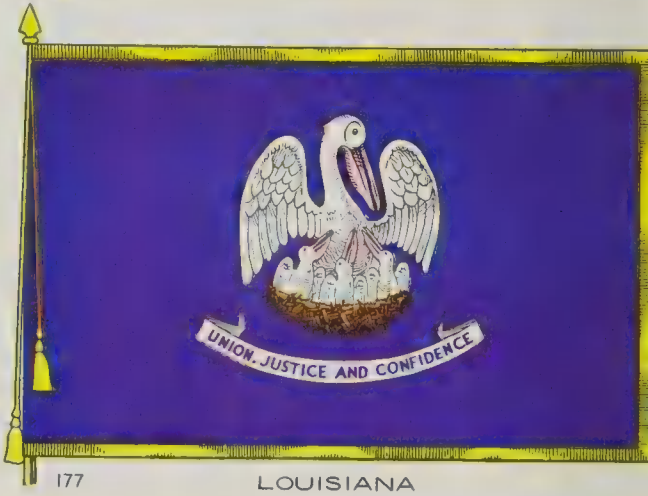
173 INDIANA



174 IOWA

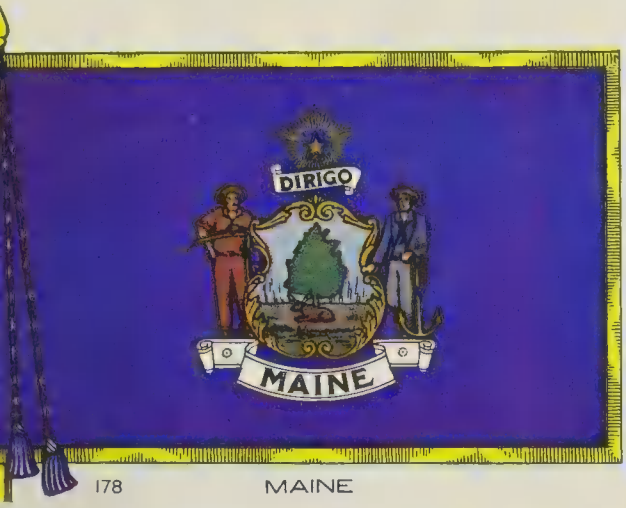
175 KANSAS

176 KENTUCKY

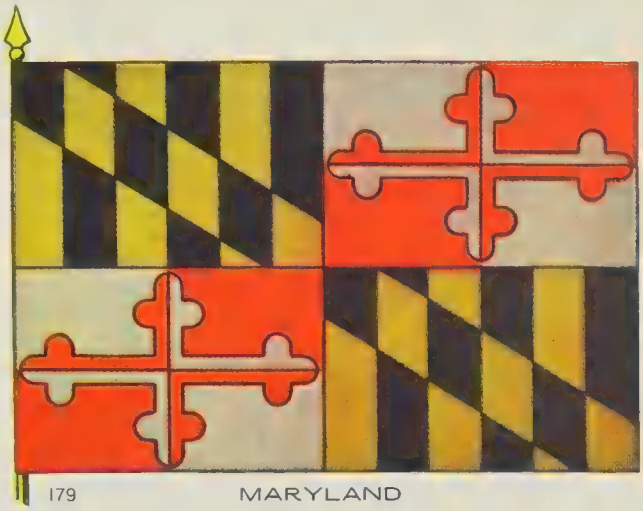


177 LOUISIANA

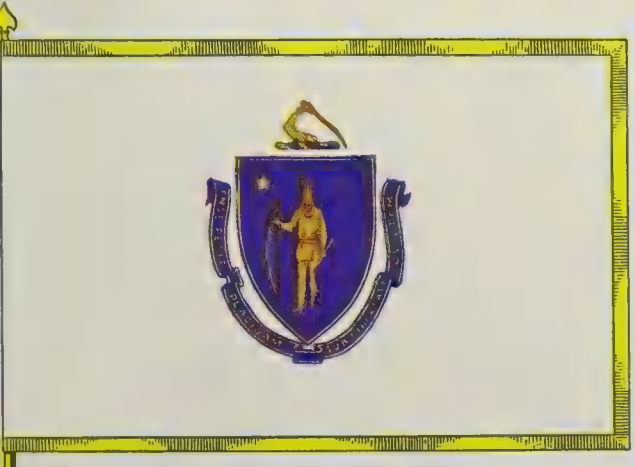
FLAGS OF THE AMERICAN COMMONWEALTHS



178 MAINE



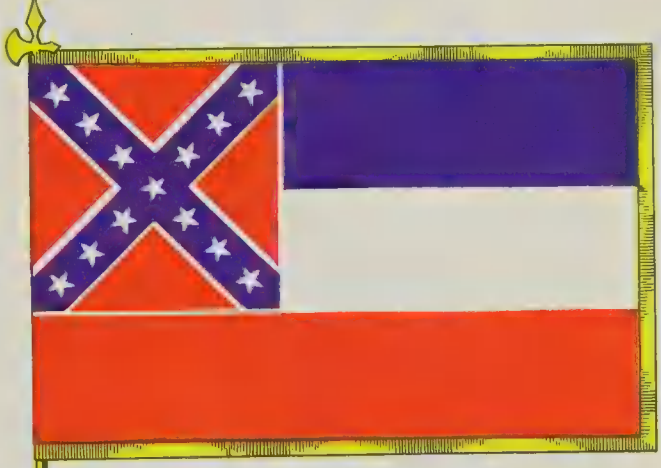
179 MARYLAND



180 MASSACHUSETTS

181 MICHIGAN

182 MINNESOTA



183 MISSISSIPPI

184 MISSOURI

185 MONTANA

FLAGS OF THE AMERICAN COMMONWEALTHS

186. Nebraska. — The legislature of Nebraska authorized the flag of that State in 1925. The seal of the State was adopted in 1867 and carries the motto "Equality before the law."

187. Nevada.—Nevada has had several State flags, the one currently used having been authorized by an act of legislature in 1929. The sagebrush shown on the flag is the State flower. The term "Battle Born" was applied to the State because it was admitted to the Union during the Civil War.

188. New Hampshire.—The State Flag of New Hampshire was adopted on February 24, 1909, the seal shown on it having been in use since 1784. In 1931 the seal of the State was redrawn, and the flag with the new seal was approved by the legislature on April 29 of that year. When used for military purposes, the flag conforms to the regulations of the flag of the United States.

189. New Jersey.—Under a resolution approved in March, 1896, the flag of the State of New Jersey was created. When the measure was pending in the New Jersey Legislature, a memorandum was submitted showing why buff was chosen. This memorandum states that in 1779 the Continental Congress by resolution authorized and directed the Commander-in-Chief to prescribe uniforms both as to color and facings for the regiments of the New Jersey Continental Line. Accordingly, General Washington in general orders directed that the coat of such regiments should be dark blue faced with buff. Later it was ordered that the flag of the State troops should have a ground the color of the facing. Thus the New Jersey flag became buff under orders of the Father of His Country. It was displayed in view of the combined French and American Armies in the great culminating event of the Revolution, the capitulation of the British Army under Cornwallis at Yorktown.

190. New Mexico.—The legislature of New Mexico on March 19, 1925, passed a law creating a flag to supersede the flag adopted in 1915. The new flag is "the ancient Zia Sun Symbol . . . The colors shall be red and yellow of old Spain." The hoist of the flag is two thirds of the fly; the sun symbol is one third the length of the fly.

191. New York.—The device on the flag of New York, authorized by legislative act in 1909, is the coat of arms of the State, which has remained unchanged since 1778.

192. North Carolina.—The flag of North Carolina was established by act of legislature on March 9, 1885. The date May 20, 1775, commemorates the "Mecklenburg Declaration of Independence," and the date April 12, 1776, commemorates the "Halifax Independence Resolutions."

193. North Dakota.—North Dakota's flag, which was given legislative sanction in 1911, is of almost unknown origin. With a slight change in the scroll below the eagle, this flag served as the regimental flag for the First North Dakota Infantry in the Spanish-American War and the Philippine Insurrection. The hoist of the flag is approximately four fifths of the fly.

194. Ohio.—The only State to adopt a pennant-shaped flag, Ohio sanctioned its banner by legislative action on May 9, 1902. The 17 stars represent all of the States at the time of Ohio's entrance into the Union.

195. Oklahoma.—On April 22, 1925, Oklahoma adopted its new State Flag. This flag depends upon the local scene for its inspiration. The circular rawhide shield fringed with pendent eagle feathers is typical of the American Indian warrior's equipment. The calumet, or peace pipe, another Indian symbol, is crossed with the olive branch of classical tradition.

196. Oregon.—A change was made in the State Flag of Oregon on February 26, 1925. The obverse of the flag carries the State escutcheon in gold supported by the 33 stars representing Oregon's place among the States. The date "1859" recalls the time of Oregon's entrance into the Union. The reverse of the flag shows a representation of the beaver in gold on a blue field.

197. Pennsylvania.—The Keystone State's Flag was officially adopted June 13, 1907. It carries the coat of arms of the State in the center of both sides. The scroll is inscribed with the words "Virtue, Liberty and Independence." The hoist of the flag is approximately three fourths of the fly in law, but in practice it is nearly square.

198. Rhode Island.—Although some authorities believe that the stars of the American Colors originated in Rhode Island's colonial flag, it was not until 1877 that this State officially adopted a flag. The flag law was revised in 1882 and again in 1897, when the existing banner was established. The hoist of the flag is approximately four fifths of the fly.

199. South Carolina.—South Carolina, when it withdrew from the Union in 1861, decided that it was a separate nation and should have a national banner. When it joined the Southern Confederacy, it kept its flag as a State banner and has maintained this flag in that capacity to the present day.

200. South Dakota.—By act of legislature in 1909, the flag of South Dakota was created. The obverse carries a picture of the blazing sun; the reverse, a reproduction of the great seal of the State. In practice, the seal is sometimes placed on the obverse side of the flag, a procedure which, while following the general principle of flag design, seems to be the opposite of the intent of the law. The hoist of the flag is approximately three fifths of the fly.

201. Tennessee.—The unique flag of Tennessee was adopted April 17, 1905. Tennessee

was the third State to join the Union after the Original Thirteen, a fact which the three stars recall. These stars also "represent the three political divisions of the State organized at different periods in its history. They are bound together by the circular blue field; the symbol represents three making one." The flag hoist is three fifths of the fly.

202. TEXAS.—The Lone Star Flag of Texas dates from the days of the Republic, the actual date of adoption being January 25, 1839. The manifold rules for the use of the flag are very explicit. The blue perpendicular stripe is one third the fly of the flag, while the two horizontal stripes are of equal breadth, the whole flag being formed by three equal-sized rectangles.

203. UTAH.—While the State Flag of Utah was approved by legislative action on March 11, 1913, the Secretary of State of Utah discovered in 1922 that the flag then in common use was not in strict accord with the description found in the law. A flag was made to conform with the description given in the statute and presented to the State. The date "1847" refers to the settling of the State, while that of "1896" refers to its admission to the Union. The sego lily shown on the shield is the State flower.

204. VERMONT.—Vermont's flag, adopted by the State Legislature in 1923, replaces an earlier flag adopted in 1837. The field of blue carries the coat of arms of the State.

205. VIRGINIA.—The State General Assembly in 1930 passed an act providing a flag for the Commonwealth. The seal portrays Virtus, the genius of the Commonwealth, dressed like an Amazon, resting on a spear in her right hand and holding a sword in the other. She treads on Tyranny, represented by a man prostrate, a crown fallen from his head, a broken chain in his left hand, and a scourge in his right. The State motto, *Sic Semper Tyrannis* (Thus ever to tyrants), appears on the arms. This seal generally duplicates the one prepared by a committee of which Richard Henry Lee and George Mason were members, and was adopted on July 5, 1776, one day after the Declaration of Independence was adopted.

206. WASHINGTON.—The State of Washington officially sanctioned in 1923 the flag which had been provided by a patriotic organization for it sometime before. The vignette of General Washington may be embroidered, printed, painted, or stamped thereon.

207. WEST VIRGINIA.—The present flag was adopted by the State Legislature May 7, 1929. The motto on the coat of arms of the State, *Montani Semper Liberi* (Mountaineers always freemen), typifies the spirit of its people.

208. WISCONSIN.—The Badger State officially acquired a banner by legislative action in 1913. The coat of arms is embroidered on each side with silk of appropriate colors. The hoist of the flag is approximately four fifths of the fly.

209. WYOMING.—The distinctive flag of Wyoming was created by an act in 1917. The hoist of the flag is seven tenths of the fly. The outside red border is one twentieth of the fly.

210. ALASKA.—The flag of Alaska was adopted in May, 1927. It was designed by a boy 13 years old, named Benny Benson. He used the constellation of the Great Bear. The seven stars represent the great dipper and the larger star indicates the North Star. The legislature of Alaska appropriated $1,000 to send the young designer to Washington to present the first flag of Alaska to the United States.

211. GOVERNOR OF THE PANAMA CANAL.—The flag of the Governor of the Panama Canal was established by an order of President Woodrow Wilson, June 8, 1915.

212. DISTRICT OF COLUMBIA.—In the absence of any official flag for the District of Columbia, the District Militia devised the one reproduced here, and until such time as it shall be replaced by law, it will be the flag of the District of Columbia, just as formerly the one with the hatchet had that status.

213. GUAM.—The flag of Guam, with its coconut tree insignia, is used subordinately to the United States flag, which is flown over all Government buildings.

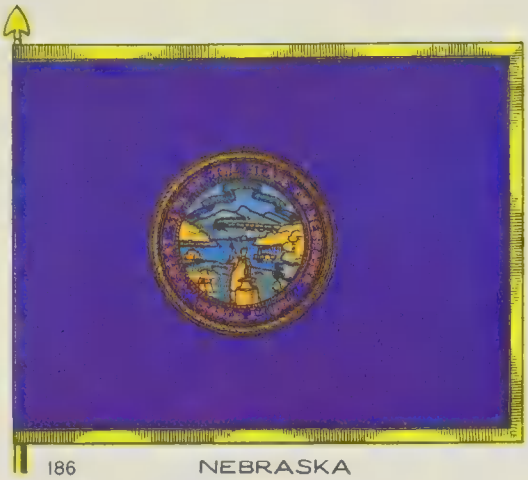
214. HAWAII.—The present flag of Hawaii was officially adopted in 1925, when a law was enacted accepting the old Hawaiian flag as the authorized flag of the Territory, second only to the Stars and Stripes.

215. PHILIPPINE ISLANDS.—The flag of the Philippine Islands had been long in use before receiving official sanction. The authorizing law, enacted in 1920, provided that it should have the next post of honor to the flag of the United States when flown with other banners.

216. THE FLAG OF THE GOVERNOR OF PUERTO RICO.—The Governor of Puerto Rico, finding that there was no official flag in use, created one for himself. It carries on a field of white the seal of Puerto Rico which was granted by Ferdinand of Spain, November 8, 1511. The inscription is *Joannes Est Nomen Ejus* (His name is John).

217. VIRGIN ISLANDS.—The flag of the Governor of the Virgin Islands was adopted by executive order and uses the American eagle displayed with a shield upon its breast and an olive branch and bundle of arrows in its dexter and sinister claws, respectively.

218. FLAG OF THE AMERICAS.—This flag, with its three wine-colored crosses and its sun of the Incas, was hoisted on October 12, 1932, in the Plaza Independencia in Montevideo. It was officially recognized and dedicated by supreme decree by the governments of Honduras, Nicaragua, Paraguay, Chile, Bolivia, Ecuador,



186 NEBRASKA

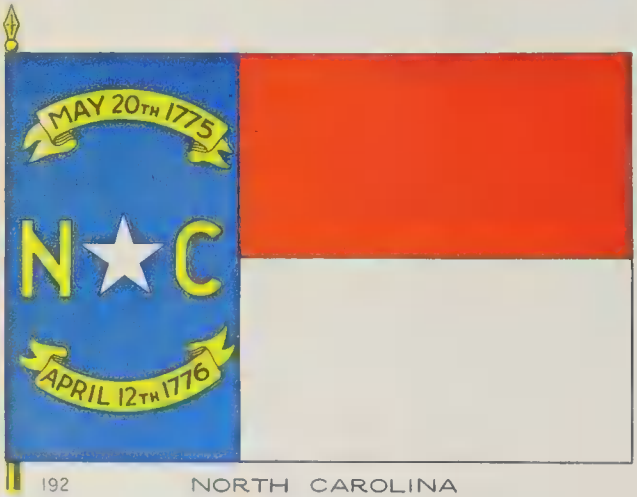
187 NEVADA

188 NEW HAMPSHIRE

189 NEW JERSEY

190 NEW MEXICO

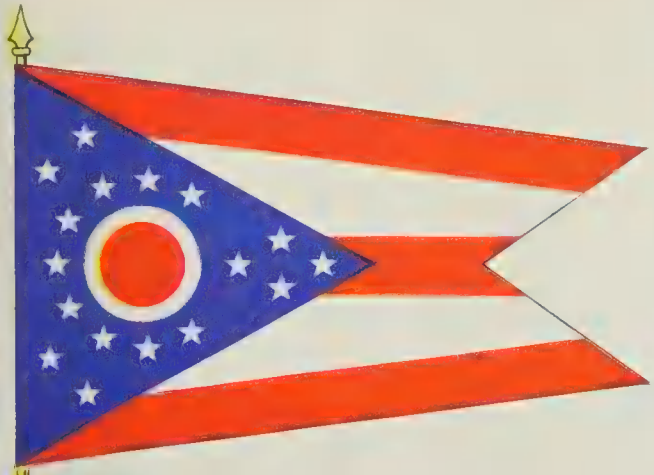
191 NEW YORK



192 NORTH CAROLINA

193 NORTH DAKOTA

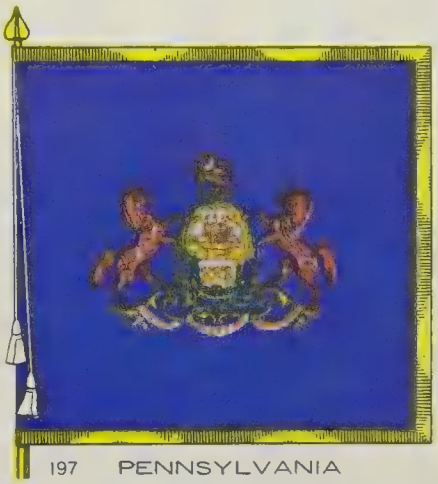
FLAGS OF THE AMERICAN COMMONWEALTHS



194 OHIO

195 OKLAHOMA

196 OREGON



197 PENNSYLVANIA

198 RHODE ISLAND

199 SOUTH CAROLINA

200 SOUTH DAKOTA

201 TENNESSEE

FLAGS OF THE AMERICAN COMMONWEALTHS

Colombia, and Peru. All of the nations of the Americas hoisted it shortly thereafter.

219. The Flag of the National Geographic Society.—With its colors of brown, green, and blue—typifying earth, sea, and sky—the banner of the National Geographic Society expresses the wide range of the interests of the organization which flies it. Explorers carrying it have fathomed the reaches of the stratosphere, plumbed the depths of the ocean, scaled the earth's main mountain peaks, peered into the remote past, sought the secrets of volcanism, crossed the earth's opposite poles, and brought the wide world to the illustrated and printed page. Ever this flag is one of both adventure and conquest—adventure because men under its ægis have dared push on beyond the realms of the known in the hope of discovering new continents of good for humanity; of conquest because it ever floats upon the distant horizon ready to march on and map the new provinces of knowledge the adventurers have discovered, so that millions still unborn may reap the golden harvest of expanding worlds of truth.

220. Flag of the Daughters of the American Revolution. — The Daughters of the American Revolution were organized in 1890 and have done a work of inestimable value in bringing to the mind of present-day America a new appreciation of what our ancestors gave of life and blood, hardship and sacrifice in order that they might bequeath to the generations coming after them the priceless jewel of liberty.

221. Flag of the Sons of the American Revolution.—Working hand in hand with the D. A. R.'s are the S. A. R.'s. America owes an immeasurable debt to its patriotic societies, for a Nation that forgets its heroic history pays a heavy price for its indifference.

222. Flag of the American Legion.—The American Legion was organized and incorporated by act of Congress in 1919. At its first annual convention held in that year in Minneapolis, it had 500.000 members and nearly 5,000 posts. Its present membership, 767,000, is enrolled in 10,800 posts.

223. Flag of the Veterans of Foreign Wars.—The veterans of Foreign Wars of the United States compose a national society founded in 1899. Its membership approximates 250,000 and it reports 2,900 posts.

224. Flag of the Young Men's Christian Association. — The Young Men's Christian Association was founded in London in 1844 and established in the United States in 1851. There are 10,619 associations throughout the world and 1,444,315 members.

225. Flag of the Young Women's Christian Association. — The Young Women's Christian Association of the United States was founded in Boston in 1866 and organized as a national body in 1906. The membership of the Association is approximately 600,000.

226. Flag of the Boy Scouts.—The organization of the Boy Scouts of America was founded February 8, 1910, and granted a charter by Congress in 1916. The work of the Boy Scouts has made a deep impression throughout the United States and the world, and the training they receive not only affects the deeper currents of their own lives but also gives them equipment for national leadership as they emerge into manhood.

227. Flag of the Girl Scouts.—The Girl Scouts, Incorporated, is a national, non-sectarian, non-partisan movement which was founded in the United States in 1912 by Mrs. Juliette Low, of Savannah. It was patterned after the association of British Girl Guides and parallels among girls the work that is done for boys through the Boy Scouts of America.

FLAGS FAMOUS IN AMERICAN HISTORY

228. Viking Banner.—Five hundred years before the arrival of Columbus in the New World, Leif Ericsson is supposed to have guided his ships to the shores of Vinland (Labrador, Nova Scotia, or New England) and planted there the Raven Banner.

229. Colors of Columbus.—The Standard of Spain was the flag which was planted on October 12, 1492, on what Columbus called San Salvador, now sometimes called Watling Island, in the Bahamas.

230. St. George's Cross — Cabot. — John Cabot raised the first English flag in North America, probably on Cape Breton Island, in 1497.

231. St. Andrew's Cross—Nova Scotia.—The inhabitants of "New Scotland" adopted the cross of "Old Scotland" for their own flag. The crown and cipher are those of James I.

232. St. Patrick's Cross.—This cross is attributed by some to St. Patrick, who was born in Scotland, and by others to Maurice Fitzgerald, a Norman invader.

233. Lilies of France.—These golden lilies were carried by the explorers Joliet, Marquette, La Salle, Iberville, and Bienville.

234. Hudson's Flag.—The letters "A.O.C." superimposed upon the Netherland flag made the banner of the Algemeene Oost-Indise Compagnie, the Dutch East India Company, under whose auspices Hudson sailed.

235. Dutch West India Company.—The letters "G. W. C." (Geoctroyeerde West-Indische Compagnie) were added to the Netherland flag in 1621 to form the banner of the company. The orange stripe was changed to red about 1650 to accord with the change made in the Netherland flag.

236. Endicott—1634.—The Massachusetts colonists objected to the use of St. George's

Cross on their flag on the grounds of idolatry. John Endicott cut out part of the cross in 1634, but in 1651 the flag was officially sanctioned.

237. KING'S STANDARD.—The first and fourth quarters of this standard as used in 1635 show the two lions introduced by William II. The third lion, according to some authorities, was added by Henry II in honor of his wife, Eleanor of Aquitaine. The Lilies of France were added by Edward II when he acquired the title of King of France in 1340. The second quarter shows the Lion of Scotland, which James I added in token of the union of the two countries. The third quarter shows the Harp of Ireland, placed there by Queen Elizabeth in token of her success in dealing with that island.

238. SWEDES' SETTLEMENTS. — The flag of Sweden used by colonists in Delaware and New Jersey has undergone little change in more than two hundred years.

239. THREE COUNTY TROOP.—In 1659 three counties in Massachusetts—Suffolk, Middlesex, and Essex—raised a company of cavalry which lasted twenty years and probably took part in King Philip's War.

240. COLONIAL ENSIGN. 243. NEW ENGLAND. 249. CONTINENTAL BANNER. 250. BUNKER HILL FLAG. 258. NEWBURY, MASS. 259. TAUNTON.—These variants of the flag of the mother country indicate that there was an ever-widening breach between England and her American Colonies.

241. ANDROS FLAG. — Edmund Andros was made governor of Massachusetts after its charter was revoked.

242. ESCUTCHEONED JACK.—To distinguish them from ships of the mother country, colonial ships were ordered in 1701 to place a white escutcheon on the British Jack.

243. NEW ENGLAND.—See 240.

244. WASHINGTON'S CRUISERS. — This flag was used by Washington's six cruisers in 1775. After the Grand Union Flag (251) came into use, this flag was adopted by the Massachusetts Navy (257).

245. RHODE ISLAND.—This flag was carried safely through the struggle at Brandywine, Trenton, and Yorktown (see 198, 246).

246. COMMANDER-IN-CHIEF.—At Valley Forge, General Washington used this flag before his tent. It has been suggested that this is a possible source of the stars in our National Flag (see 198).

247. WASHINGTON'S GUARD.—The Life Guard, in which all of the States supplying troops to the Continental Army were represented, carried this flag with the motto "Conquer or die."

248. PRE-REVOLUTIONARY JACK. — This flag was probably displayed by the *Mayflower* and by the ships which brought the English settlers to Jamestown. After 1710 it was the only flag officially used on land over public buildings in the Colonies.

249. CONTINENTAL BANNER.—See 240.

250. BUNKER HILL FLAG.—See 240.

251. THE GRAND UNION FLAG. — This flag served as the outward symbol of the Union of the Colonies from December 3, 1775, until the adoption of the Stars and Stripes (see page 344).

252. NAVY JACK. 253. GADSDEN. 256. SOUTH CAROLINA NAVY ENSIGN. 257. MASSACHUSETTS NAVY. 262. CULPEPPER. 275. WESTMORELAND.—These flags give some indication of the popularity of the snake design in Revolutionary times.

254. LIBERTY TREE—1776.—General Gage ordered the tree under which the Sons of Liberty met in Boston cut down. Thereafter the device frequently appears. When the flag of Washington's Cruisers (244) was taken over by the Massachusetts Navy (257), the coiled snake was added.

255. LINKED HAND.—Thirteen mailed hands grasping as many links of a chain foreshadowed the national motto *E Pluribus Unum*.

256. SOUTH CAROLINA NAVY ENSIGN.—See 252. Most of the Colonies maintained their own navies. Those of Massachusetts, Rhode Island, and South Carolina were particularly effective.

257. MASSACHUSETTS NAVY.—See 252.

258. NEWBURY, MASSACHUSETTS.—See 240.

259. TAUNTON.—See 240 and illustration, page 368.

260. COLONEL MOULTRIE.—This is, according to Moultrie's memoirs, "the first American flag displayed in the South."

261. BENNINGTON.—On August 16, 1777, this flag was carried at the Battle of Bennington, Vermont. This battle, in which Burgoyne's foraging forces were turned back and routed, paved the way for the American triumph at Saratoga.

262. CULPEPPER.—See 252.

263. FORT MOULTRIE.—It was over Fort Sullivan, later named Fort Moultrie, that this flag was raised at the battle on June 28, 1776.

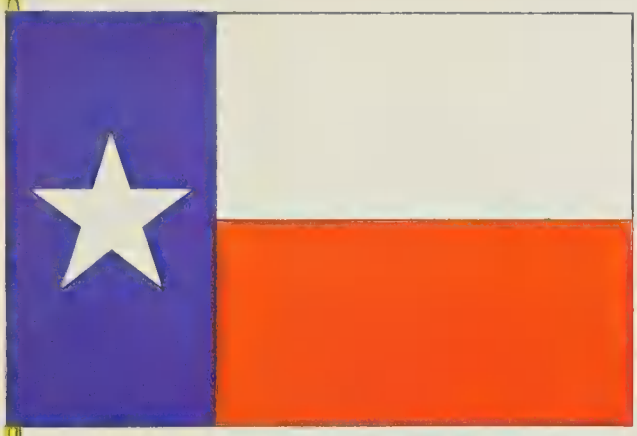
264. THIRD MARYLAND.—This adaptation of the Stars and Stripes was carried by the Third Maryland Regiment at the Battle of Cowpens.

265. NEW YORK.—Recalling the fur trade of early days, this flag was used on the armed ships of New York in 1775.

266. BUCKS OF AMERICA.—John Hancock, first governor of the State of Massachusetts, presented this banner to the colored company of that name for their valor.

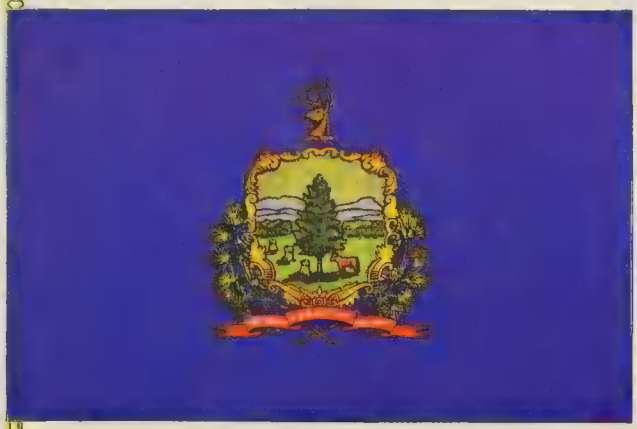
267. GUILFORD.—The flag raised at Guilford Courthouse, March 15, 1781, is an evidence of the lack of specific regulations regarding the construction of the flag, as also in 261, 264.

268. HANOVER ASSOCIATORS.—These "volunteers" decided as early as June, 1774, "that in



202 TEXAS

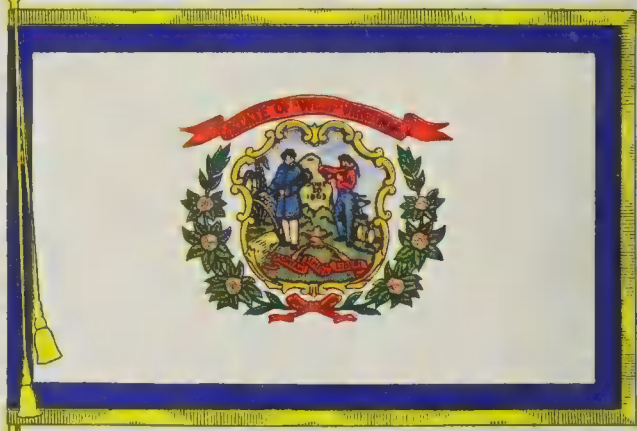
203 UTAH



204 VERMONT

205 VIRGINIA

206 WASHINGTON



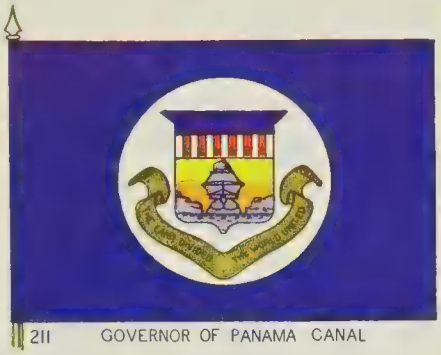
207 WEST VIRGINIA

208 WISCONSIN

209 WYOMING

FLAGS OF THE AMERICAN COMMONWEALTHS

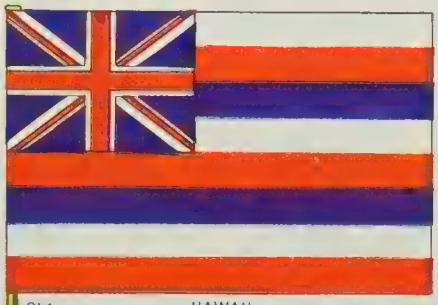
210 ALASKA



211 GOVERNOR OF PANAMA CANAL

212 DISTRICT OF COLUMBIA

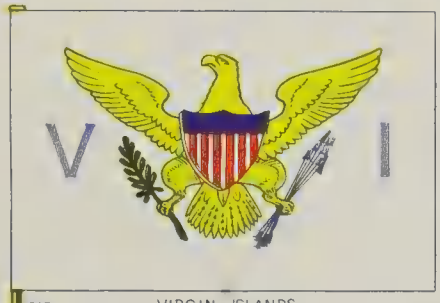
213 GUAM



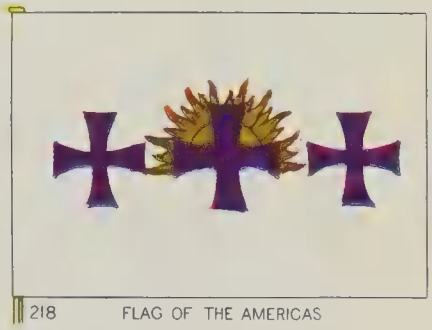
214 HAWAII

215 PHILIPPINES

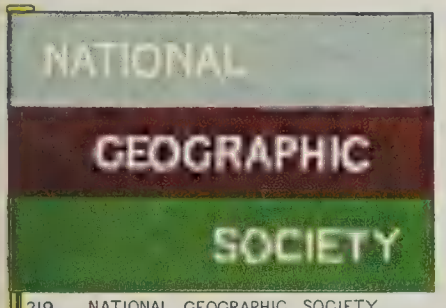
216 PUERTO RICO



217 VIRGIN ISLANDS

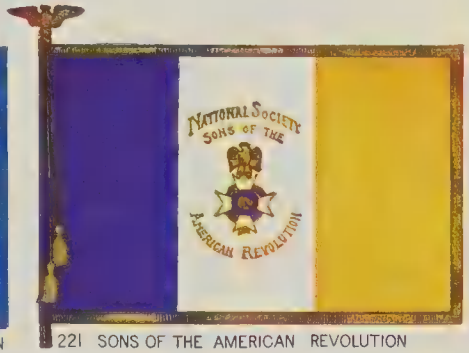


218 FLAG OF THE AMERICAS



219 NATIONAL GEOGRAPHIC SOCIETY

220 DAUGHTERS OF THE AMERICAN REVOLUTION



221 SONS OF THE AMERICAN REVOLUTION

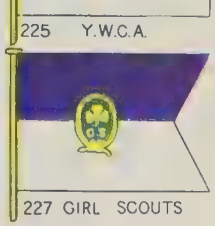
222 AMERICAN LEGION

223 VETERANS OF FOREIGN WARS

224 Y.M.C.A.

225 Y.W.C.A.

226 BOY SCOUTS



227 GIRL SCOUTS

FLAGS OF U. S. TERRITORIES, POSSESSIONS, AND NATIONAL SOCIETIES

THE TAUNTON FLAG IS RAISED ON THE VILLAGE GREEN

Ralph Davol painted this mural for the Massachusetts town's public library. It portrays the raising of a historic banner, a British Red Ensign with "Liberty and Union" superimposed—one of the forerunners of the Grand Union Flag (see No. 251). The Reverend Caleb Barnum invokes a blessing, while David Cobb, afterward one of Washington's generals, hoists it to the top of the Liberty Pole, October 21, 1774. Robert Treat Paine, a signer of the Declaration of Independence, stands at the right, resting on his cane.

the event of Great Britain attempting to force unjust laws upon us by the strength of arms, our cause we leave to Heaven and our rifles."

269. Merchant 1776-1795.—Merchant vessels and privateers nearly always carried this ensign of thirteen stripes, the colors of the stripes varying with the fancy of the commanding officer.

270. First Stars and Stripes.—The act of Congress of June 14, 1777, which gave our country its National Flag did not specify the arrangement of the stars. In the Navy it became customary to place the stars so as to form the crosses of St. George and St. Andrew, an arrangement illustrated in the Rhode Island banner (245).

271. New York Regiment.—These regimental colors were carried by Col. Peter Gansevoort at Yorktown. It will be seen that the coat of arms of the State (191) has remained almost unchanged in general design.

272. Philadelphia Light Horse.—This troop carried their yellow colors when it escorted Washington from Philadelphia to New York on his way to Cambridge to take command of the Continental Army.

273. Tallmadge's Dragoons.—Maj. Benjamin Tallmadge and his dragoons fought at Brandywine and Germantown, Pennsylvania, and Monmouth, New Jersey.

274. Connecticut.—The activities of 1775 and 1776 showed the need of colors to distinguish the various troops. Connecticut was one of the first States to adopt a banner (see 167).

275. Westmoreland.—The Westmoreland County Battalion of Pennsylvania was raised in 1775 by John Proctor.

276. Webb's Regiment.—This little flag belonged to the troops under Colonel Webb, probably the Third Connecticut Regiment.

277. First Pennsylvania Rifle Regiment.—The regiment which carried this flag fought in every one of the Thirteen Colonies.

278. Bedford.—The Bedford Minute Men carried this flag, only two and one half feet square, with its brave motto "Conquer or die," at the Battle of Concord.

279 and 280. New Hampshire Regiment.—These two flags of the Second Regiment were captured by the British Ninth Regiment shortly before the Battle of Saratoga and returned to the New Hampshire State Historical Society in 1912.

281. Eutaw.—Miss Jane Elliott cut a square of damask from a drawing room chair to give her fiancé, Col. William Washington, for a flag. It was carried at Cowpens and Eutaw Springs, South Carolina.

282. Pulaski.—This banner was embroid-

ered for Count Pulaski by the Moravian Sisters of Bethlehem, Pennsylvania.

283. White Plains.—American troops surrendered this flag to Hessian troops at the Battle of Long Island, August 26, 1776.

284. Gatinois Regiment. 285. Saintogne (or Saintonge) Regiment. 286. Royal Deux Ponts Regiment.—These French regiments were a part of the French allies of America during the Revolution.

287. Champlain and De Grasse.—Samuel de Champlain used this flag in 1609 on the lake which bears his name. One hundred and seventy-two years later Count de Grasse with his 24 ships sailing under the same flag entered the Chesapeake Bay and cut off British communication between New York and Yorktown, thus aiding materially in forcing the final surrender of the Revolution.

288. Louisiana.—The Stars and Stripes replaced this flag on December 20, 1803, when the vast Territory was added to this country.

289. Russian American Company, Alaska.—This company organized in 1799, remained dominant in Alaskan affairs for 60 years.

290. Fort McHenry Flag.—When Vermont entered the Union (March 4, 1791) and then Kentucky (June 1, 1792), it was felt that they should have a representation similar to that of the Original Thirteen States, and Congress passed an act on January 13, 1794, adding two stripes and two stars to the flag. This was the flag which inspired Francis Scott Key to write *The Star-Spangled Banner*.

291. Perry's Signal.—At the Battle of Lake Erie, September 10, 1813, Commodore Perry fought under a flag carrying the last words of brave Captain Lawrence.

292. Standard—1812.—This is the national standard as used by our light artillery in the War of 1812.

293. Great Star Flag. 294. Flag of July 4, 1818.—In 1818 the number of States in the Union had increased to twenty, and it was seen that to increase the number of stripes of the flag indefinitely would render them invisible at a distance. At the instance of Capt. Samuel C. Reed, Congress passed an act providing for the return to the original thirteen stripes and the addition of a new star for each new State. Reed also suggested that merchant ships have the stars arranged like a great star and war vessels in parallel rows. The addition of new States made the great star arrangement impracticable, and it was soon abandoned.

295. Alamo.—This flag floated over the Alamo, the fortress at San Antonio, when Texas was fighting for independence.

296. Texas Naval.—After seceding from Mexico, Texas adopted this naval flag (April 9, 1836), antedating by several months the adoption of the first national flag of Texas.

297. Marine Corps Colors—1830-50.—These colors carry the legend "From Tripoli to the Halls of the Montezuma," referring to the engagements in which the Marines had participated.

298. U. S. Flag—Civil War.—The Government did not change its flag during the Civil War or drop the stars representing the seceding States.

299. Artillery Colors—Civil War.—The 36 stars show that this flag was used after the admission of West Virginia and Nevada to the Union.

300. Infantry Colors—Civil War.—Note the close resemblance these colors bear to the Standard of 1812 (292).

301. Artillery Regiments—Civil War.—The designation of the various regiments is given on the scroll below the crossed cannon.

302. Cavalry Guidon—Civil War.—This guidon was dropped when General Sherman was made Secretary of War, and the former guidon (69) was restored.

303. First Confederate Flag.—The Stars and Bars were used from March, 1861, to May, 1863.

304. Confederate Naval Ensign.—This was displayed by the ships of the Confederacy probably from 1861 to 1863.

305. Confederate Battle Flag and Naval Jack.—The flag as here shown was used as the Confederate Jack after May 1, 1863. The battle flag was like it except that it was square and all four sides were bordered with white.

306. Confederate Flag—1863.—The Confederacy used this as its national flag from May 1, 1863, to March 4, 1865.

307. Confederate Flag—1865.—This flag was adopted March 8, 1865.

308. Aztec Standard.—Cortez took this standard at the battle of Otumba.

309. Tlaxcalan Banners.—These banners belonged to a tribe which was Cortez's ally against the Aztecs.

310. Inca Banners Before Pizarro.—The Incas used gaudy plumage from tropical birds to make the halyards supporting these banners.

311. Cortes (Cortez) Standard.—Seeking gold and glory, the Spanish explorers carried the banners of the Church with them.

312. First Mexican Flag.—The eagle and serpent are still found on the Mexican flag (492).

313. Spanish Mexican.—Spanish troops carried this flag in the Mexican War of Independence.

314. Pizarro.—This is the banner which Pizarro is said to have carried when he entered Cuzco a conqueror in 1533.

315. Order of Christ.—Denys, King of Portugal, instituted this order in 1231 to expel the Moors from Bética. The Brazilian branch in later times used its banner in its activities in South America, particularly in Brazil.

FLAGS FAMOUS IN AMERICAN HISTORY

278 BEDFORD

279 N.H. REGT.

280 N.H. REGT.

281 EUTAW

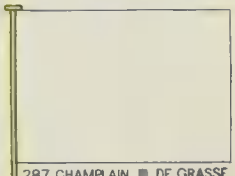
282 PULASKI.

283 WHITE PLAINS

284 GATINOIS REGT.

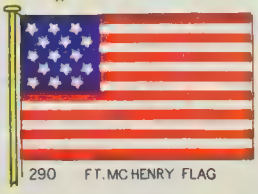
285 SAINTOGNE REGT.

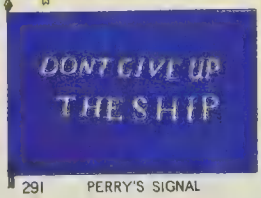
286 ROYAL DEUX PONTS REGT.


287 CHAMPLAIN ■ DE GRASSE

288 LOUISIANA - 1803

289 RUSSIAN AMERICAN


290 FT. MCHENRY FLAG

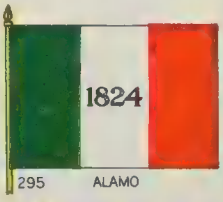


291 PERRY'S SIGNAL

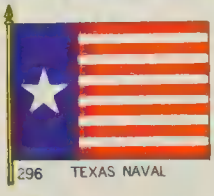
292 STANDARD - 1812

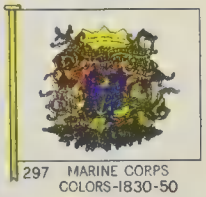
293 GREAT STAR FLAG

294 FLAG OF JULY 4, 1818



295 ALAMO


296 TEXAS NAVAL


297 MARINE CORPS COLORS - 1830-50

298 U.S. FLAG - CIVIL WAR

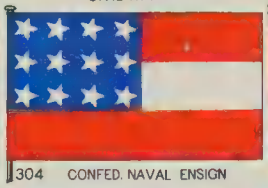
299 ARTILLERY COLORS CIVIL WAR

300 INFANTRY COLORS CIVIL WAR

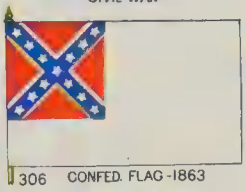
301 ARTILLERY REGTS CIVIL WAR

302 CAVALRY GUIDON CIVIL WAR

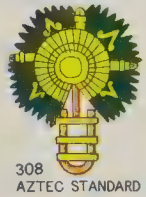
303 FIRST CONFEDERATE FLAG 1861


304 CONFED. NAVAL ENSIGN

305 CONFED. BATTLE FLAG & NAVAL JACK


306 CONFED. FLAG - 1863

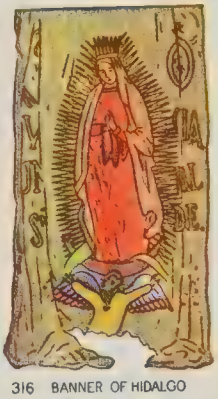
307 CONFED. FLAG - 1865


308 AZTEC STANDARD

309 TLAXCALAN

310 INCA BANNERS BEFORE PIZARRO

311 CORTES STANDARD

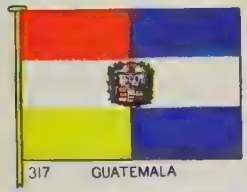

316 BANNER OF HIDALGO

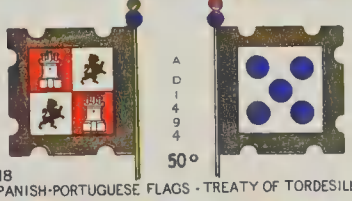
312 FIRST MEXICAN FLAG

313 SPANISH MEXICAN

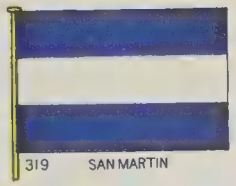
314 PIZARRO

315 ORDER OF CHRIST


317 GUATEMALA



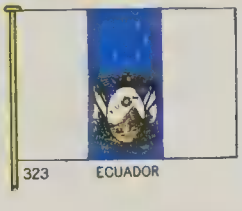
318 SPANISH-PORTUGUESE FLAGS - TREATY OF TORDESILLAS


319 SAN MARTIN

320 ARMY OF THE ANDES

321 BOLIVAR

322 NEW GRANADA


323 ECUADOR

324 SOUTH PERU

325 EMPIRE OF BRAZIL

316. Banner of Hidalgo.—Mexico's soldier priest, who started a revolution against the Spanish rule, carried the sacred banner of the Virgin of Guadalupe.

317. Guatemala.—The flag here shown was used from May 31, 1838, until the present one was adopted (472).

318. Spanish-Portuguese Flags—Treaty of Tordesillas.—The treaty on which these flags appear gave Spain the control of almost the entire Continent of South America.

319. San Martín.—This banner was carried by General San Martín, who was born in Argentina and came to be known as "The Liberator of the South." After winning the freedom of his own country, he aided in the liberation of Chile and Peru.

320. Army of the Andes.—General San Martín carried this banner over the Andes into Chile.

321. Bolívar.—It was under this flag that Simón Bolívar liberated Venezuela, Colombia, and Peru from imperial Spain.

322. New Granada.—The confederation of South American States, now largely included in the Republic of Colombia, used this flag.

323. Ecuador.—When Ecuador was a part of the Republic of Colombia, it used this standard.

324. South Peru.—This was a short-lived flag, since the Peruvian-Bolivian Confederation, to which it belonged, endured only two years.

325. Empire of Brazil.—Driven out of their own country in 1808 by Napoleon's forces, the royal family of Portugal took refuge in Brazil, where they ruled until 1889, when the people revolted and established a republic.

FLAGS AND BADGES OF THE BRITISH EMPIRE

With all of its complex system of central government, dominions, colonies, protectorates, dependencies, and mandated territories located on every continent and among the islands of the Seven Seas, the British Empire has had to create the world's largest single group of flags and to develop the most complete body of flag regulations in the whole history of civilization. Wherever British authority extends, its principal symbol is the Union Flag (326).

Subordinate thereto are the Naval Ensign (327), which is carried by the British naval vessels; the British Merchant Flag (328), which is carried on privately owned ships; and the British Naval Reserve Ensign (329), which is carried not only by ships in the public and Admiralty services but also by merchant ships which fulfill the specifications of the Naval Reserve Acts. In the case of the public and Admiralty services at home and abroad, the Blue Ensign carries on its fly the badge of the service represented. Some of the dependencies and the Confederated Malay States have flags of their own, such as we see from 421 to 433 inclusive.

326. British Union Flag.—This flag, with its combination of the Crosses of St. George (230), St. Andrew (231), and St. Patrick (232), was proclaimed on January 1, 1801, after the union with Ireland, throughout the Empire. Those who rule under it carry the badges of their respective territories at the intersection of its crosses, surrounded either by the laurel wreath as shown in 420, or by special wreaths as in the case of Australia, shown in 337, and of New Zealand, shown in 338.

327. British Naval Ensign.—Originally, the colors of the White, Red, and Blue Ensigns were borne by different warships to designate the squadrons to which they respectively belonged. The confusion that resulted was responsible for the placing of all naval vessels under the White Ensign, and the employment of the others to designate non-naval ships. The British Admiralty Regulations provide that no warship shall dip its flag to any foreign ship whatsoever unless the foreign ship at first or at the same time lowers its flag.

328. British—Merchant.—No other flag flutters to the breeze of as many ports or sails as far and wide as the Red Ensign of the British Merchant Marine. More passengers sail and more freight is carried under its ægis than under that of any other flag in existence.

329. Naval Reserve Ensign.—The Blue Ensign of the British Empire is flown by Naval Reserve vessels, public offices afloat, the Consular Service, and the Government vessels of the several dominions, colonies, and dependencies. It also is flown with appropriate badges over many types of public buildings.

330. Royal Standard.—With its three golden lions representing England, its red lion rampant standing for Scotland, and its golden harp speaking for Ireland, the Royal Standard in its present form was raised with the accession of Queen Victoria to the throne in the year 1837.

331. Australia—Merchant.—The Merchant Flag of Australia, with its constellation of the Southern Cross, came into being in 1903. The large star originally had six points, but in 1908 the number of points was increased to seven to represent the six States and the territories of the Commonwealth. The Union Flag of the Empire, the Commonwealth or Blue Ensign, as well as the Merchant Flag, are all used on land.

332. New Zealand—Blue Ensign.—The Blue Ensign, with the red stars of the constellation of the Southern Cross, constitute the National Flag of New Zealand. It came into use in 1901. As in the case of Australia, the Union Flag and the Red Ensign also are used on land as occasion demands.

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THE "EMANUEL," FLYING A PALESTINE FLAG, ANCHORS AT SOUTHAMPTON, ENGLAND

This Jewish trading vessel was the first to fly her country's new banner. Palestine, under British mandate, has a badge (see No. 419), but its Jewish population has created this flag of their own—Solomon's seal on a field of blue and white.

333. Canada — Merchant. — Canada was the first British dominion to have a distinct Merchant Flag. The badge noted thereon illustrates the position of all badges on the Red and Blue Ensigns of the Empire. In 1892, some time after the arms of Ontario, Quebec, Nova Scotia, and New Brunswick were combined in one shield, the British Admiralty gave her the right to place her arms on the fly of the Red Ensign. The present arms of Canada were granted on November 21, 1921.

334. Irish Free State.—The National Flag of the Irish Free State, with its equal vertical stripes of green, white, and orange, is said to have originated in 1848 when the deputation of the Young Ireland movement returned from France, bringing with them such a flag made of the richest French silk, gorgeously trimmed and embroidered. The green represents the Catholics of Ireland, the orange the Protestants of Ireland, and the white the permanent peace invoked between them. In 1914 Patrick Pearse adopted it for his company of Irish Volunteers, and it was raised by them over the general post office in Dublin in 1916.

335. South Africa, Union of.—In this National Flag is reproduced the old Orange Free State Flag, the Union Flag of Great Britain, and the old Transvaal Vierkleur. Government vessels wear the Blue Ensign with the arms of South Africa on the fly. Merchant vessels carry the Red Ensign with these arms in a white circle on the fly. The South Africa National Flag was adopted in 1927 after bitter controversy. On certain official buildings the Union Flag is hoisted with it on a separate staff of equal height. The two flags thus simultaneously displayed must be of the same size and must be hoisted and lowered together.

336. Canada Badge.—This badge, which is placed on the Canada Ensign, has in its first quarter the three yellow lions on a red ground, for England; in the second quarter, the red lion rampant on a yellow ground within a floriated border, for Scotland; in the third quarter, the Irish harp on a blue ground, for Ireland. The lilies of France on the blue ground in the fourth quarter bespeak the days of French rule in the Canadian provinces. The three green maple leaves on the white ground speckled with blue at the bottom of the coat of arms complete the badge of Canada.

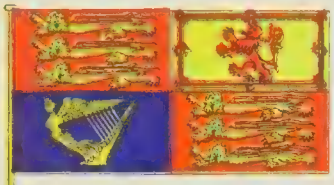
337. Australia Badge.—As shown, this is the badge of the Governor General, which is imposed upon the intersection of the crosses in

326 BRITISH UNION FLAG

327 BRITISH NAVAL ENSIGN

328 BRITISH-MERCHANT

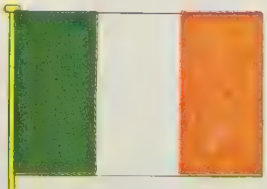
329 NAVAL RESERVE ENSIGN


330 ROYAL STANDARD

331 AUSTRALIA-MERCHANT

332 NEW ZEALAND-BLUE ENSIGN

333 CANADA-MERCHANT


334 IRISH FREE STATE

335 SOUTH AFRICA

336 CANADA-ENSIGN

337 AUSTRALIA-UNION FLAG

338 NEW ZEALAND-UNION FLAG

339 INDIA-ENSIGN

340 ALBERTA

341 BRITISH COLUMBIA

342 MANITOBA

343 NEW BRUNSWICK

344 NEWFOUNDLAND-ENSIGN

345 NOVA SCOTIA

346 ONTARIO

347 PRINCE EDWARD ISLAND

348 QUEBEC

349 SASKATCHEWAN

350 YUKON TERRITORY

351 BAHAMAS-ENSIGN

352 BARBADOS-ENSIGN

353 BERMUDA-ENSIGN

354 BRITISH GUIANA-ENSIGN

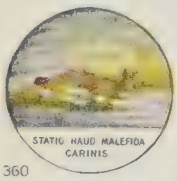
355 BRITISH HONDURAS-ENSIGN

356 FALKLAND ISLANDS-ENSIGN

357 GRENADA-ENSIGN

358 JAMAICA-ENSIGN

359 LEEWARD ISLANDS-ENSIGN



360 ST LUCIA-ENSIGN

361 ST VINCENT-ENSIGN

362 TRINIDAD & TOBAGO-ENSIGN

363 TURKS & CAICOS-ENSIGN

364 WINDWARD ISLANDS-UNION FLAG

365 NEW SOUTH WALES

366 QUEENSLAND

367 SOUTH AUSTRALIA

368 VICTORIA

369 WESTERN AUSTRALIA

370 PAPUA TERRITORY

371 TASMANIA

372 FIJI ISLANDS-ENSIGN

373 COMMISSIONER, NEW HEBRIDES-ENSIGN

FLAGS AND BADGES OF THE BRITISH EMPIRE

374 WESTERN PACIFIC COMNR. UNION FLAG

375 WESTERN SAMOA-ENSIGN

376 STRAITS SETTLEMENTS-ENSIGN

377 CEYLON-ENSIGN

378 HONG KONG-ENSIGN

379 LABUAN

380 MAURITIUS -ENSIGN

381 SEYCHELLES - ENSIGN

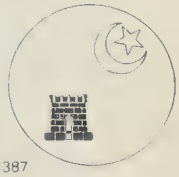
382 WEIHAIWEI - ENSIGN

383 BARODA-ENSIGN

384 BHAUNAGAR-ENSIGN

385 CAMBAY-ENSIGN

386 COCHIN-ENSIGN


387 JANJIRA-ENSIGN

388 JUNAGADH-ENSIGN

389 KUTCH-ENSIGN

390 MALACCA

391 MORVI-ENSIGN

392 NAVANAGAR-ENSIGN

393 PORBANDAR-ENSIGN

394 SACHIN-ENSIGN

395 SINGAPORE-ENSIGN

396 TRAVANCORE-ENSIGN

397 WELLESLEY

398 GAMBIA-ENSIGN

399 GOLD COAST-ENSIGN

400 KENYA-ENSIGN

401 NIGERIA-ENSIGN

402 NORTHERN RHODESIA-ENSIGN

403 NYASALAND-ENSIGN

404 ST. HELENA

405 SIERRA LEONE-ENSIGN

406 SOMALILAND-ENSIGN

407 SOUTHERN RHODESIA-ENSIGN

408 TANGANYIKA-ENSIGN

409 UGANDA-ENSIGN

410 ZANZIBAR-UNION FLAG

411 ALDERNEY-UNION FLAG

412 CYPRUS

413 GIBRALTAR-ENSIGN

414 GUERNSEY-UNION FLAG

415 ISLE OF MAN-UNION FLAG

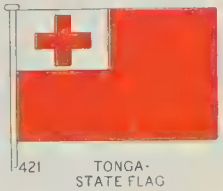
416 JERSEY-UNION FLAG

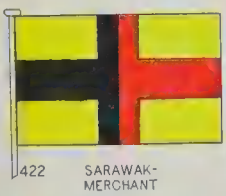
417 MALTA-ENSIGN

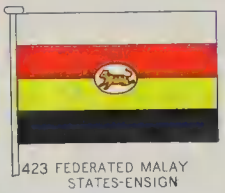
418 NORTHERN IRELAND-UNION FLAG

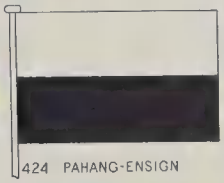
419 PALESTINE-ENSIGN

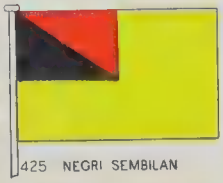
420 WREATH

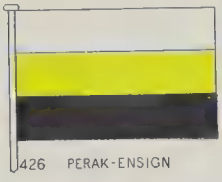

421 TONGA-STATE FLAG

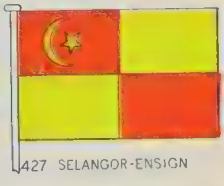

422 SARAWAK-MERCHANT


423 FEDERATED MALAY STATES-ENSIGN

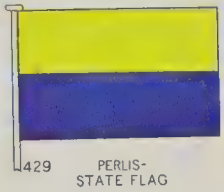

424 PAHANG-ENSIGN


425 NEGRI SEMBILAN


426 PERAK-ENSIGN

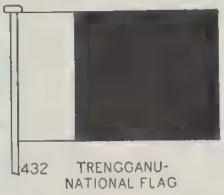

427 SELANGOR-ENSIGN

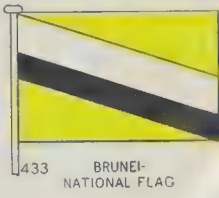
428 KELANTAN-STATE FLAG


429 PERLIS-STATE FLAG

430 JOHORE-NATIONAL FLAG

431 KEDAH-NATIONAL FLAG


432 TRENGGANU-NATIONAL FLAG


433 BRUNEI-NATIONAL FLAG

FLAGS AND BADGES OF THE BRITISH EMPIRE

the Union Flag. The crown above the star bespeaks royal authority.

338. New Zealand Badge.—When surrounded by a wreath of palm leaves, as shown, and imposed upon the intersections of the crosses of the Union Flag, it becomes the Governor General's emblem of authority. Its four stars pay honor to the Southern Cross.

339. India Badge.—As shown here, the Star of India is worn on the Blue Ensign. Surmounted by a royal crown and placed at the intersection of the crosses in the Union Flag, it becomes the emblem of the Viceroy and Governor General.

340. Alberta Badge.—With its red St. George's Cross in the upper part, its glimpse of the snow-covered Canadian Rockies, its green hills, its wide prairie, and its waving wheat field, Alberta has a handsome shield.

341. British Columbia Badge.—British Columbia was granted her arms in 1906. They display a Union Flag at the top with a crown in its center and a sun with golden rays at the bottom. The inscription on the badge is *Splendor Sine Occasu,* which, freely translated, means "A radiance with no setting."

342. Manitoba Badge.—Manitoba's arms were assigned her in 1847. Beneath the red Cross of St. George stands a buffalo.

343. New Brunswick Badge.—New Brunswick was assigned its arms by Royal Warrant in 1868. The lion at the top betokens England, and the ancient galley or lymphad speaks of the maritime situation of the Province.

344. Newfoundland Badge.—Britain's oldest colony possesses a coat of arms granted in 1637. Its badge, however, which is always used upon the flags, shows the figures of Mercury, a kneeling sailor, and Britannia. When used with the Union Flag, the device is surrounded by a garland, but when used with either the Red or Blue Ensign the garland is omitted. The inscription on the badge is *Haec Tibi Dona Fero,* which, translated, is "I bring you these gifts."

345. Nova Scotia Badge.—In 1929 Nova Scotia grew tired of the silver salmon and Scotch thistles of her old badge and was given another, which consists of a white shield with a blue saltier cross, at the intersection of which is imposed a smaller shield charged with the Royal Arms of Scotland.

346. Ontario Badge.—The simple badge of Ontario dates from 1869.

347. Prince Edward Island Badge.—This emblem was granted by Royal Warrant in 1905. The motto, *Parva Sub Ingenti,* proclaims humility. Freely translated, it reads, "The small under the large."

348. Quebec Badge.—The insignia of historic Quebec consists of a golden shield across the middle of which is a red fess charged with a golden lion of England. The fleurs-de-lis at the top are reminiscent of the old French rule, and the spray of maple leaves at the bottom bespeaks Canada.

349. Saskatchewan Badge.—Saskatchewan was made a province in 1905, but it has been awarded its badge only recently.

350. Yukon Territory Badge.—This is another of the more recent badges adopted by Admiralty Warrant.

351. Bahama Islands Badge.—When placed on the Blue Ensign, the badge of the Bahamas is used as reproduced here. When used on the Union Flag, it is imposed on a white disk for contrast and circled with the usual laurel wreath. The inscription on the Bahama badge reads *Commercia Expulsis Piratis Restituta,* which, translated, is "Commerce restored on the defeat of the pirates."

352. Barbados Badge.—This is an illustration of the type of badge which needs no white background to set it off. It is attached directly to the fly of the Blue Ensign and to the cross-intersection of the Union Flag. It shows Britannia, with her crown and trident, standing in a shell which is being drawn by sea horses.

353. Bermuda Badge.—This badge is reproduced as it appears on the Blue and Red Ensigns. When it is used on the Union Flag, it is first placed on a white circular disk within the usual laurel wreath. The lion supports a smaller shield on which is a representation of the wreck of the *Sea Venture* in 1609. Bermuda was granted her coat of arms in 1910.

354. British Guiana Badge.—Used on the Blue Ensign, this badge appears as illustrated. On the Union Flag it is set on a circular disk of white and bordered with the official laurel wreath. *Damus Petimusque Vicissim,* which may be translated "We give and seek in turn," is the inscription on the badge.

355. British Honduras Badge.—The badge of British Honduras is designed on the lines of the coat of arms granted in 1907. The tools in the upper right-hand third of the shield are the axes and saw of the mahogany feller, an allusion to the fact that British Honduras is famous for its mahogany. The badge is worn on the Blue Ensign as reproduced. On the Union Flag it is placed on a white circular disk at the intersection of the crosses, and surrounded by the official laurel wreath.

356. Falkland Islands Badge.—This badge shows a white bull standing in tussock grass, with a full-rigged frigate in the river near by. This badge is used both on the Blue Ensign and the Union Flag in the form it appears here, though it is, of course, surrounded by the laurel wreath when used on the Union Flag.

357. Grenada Badge.—This badge is used on the Blue Ensign. It shows a two-masted, lugsailed vessel with a large stern cabin, approaching a coast. Translated, the legend on

the scroll, *Clarior e Tenebris,* means "Brighter out of the darkness."

358. Jamaica Badge.—Jamaica uses as her badge the coat of arms granted her in 1661. The shield bears the red Cross of St. George, which is charged with five golden pineapples. This badge is used as reproduced on both the Union Flag and the Blue Ensign, the official laurel wreath encircling it when used on the Union Flag. The motto on the scroll, *Indus Uterque Serviet Uni,* declares that "Both Indies will serve one."

359. Leeward Islands Badge.—It is said that the badge of the Leeward Islands was designed by its first Governor, Sir Benjamin Pine, and that he set the pineapples in their place of prominence as a pun upon his name. The badge is used on the Blue Ensign as reproduced, and on the Union Flag with the regulation garland of laurel.

360. St. Lucia Badge.—St. Lucia is the chief coaling station for the British Fleet in the West Indies. The Union Flag is seen floating over one of the forts in the foreground and the Red Ensign over the other. The badge is used on the Blue Ensign as reproduced. The legend, *Statio Haud Malefida Carinis,* is a quotation from the *Æneid,* which means "A trustworthy mooring place for ships."

361. St. Vincent Badge.—This badge is taken from the coat of arms of St. Vincent, granted in 1912. It presents a classical tableau showing a yellow altar upon which a kneeling woman is offering a sacrifice to the flames, while a standing woman holds an olive branch over her head. This badge is worn as reproduced, on the Blue Ensign. The motto reads *Pax et Justitia,* which is "Peace and justice."

362. Trinidad and Tobago Badge.—This badge shows two ships at anchor, a wharf with a Blue Ensign on it, a boat in the foreground, and a high mountain in the distance. The badge is used on the Blue Ensign as shown, and on the Union Flag surrounded by the emblematic laurel wreath. "She is satisfied to unite nations and to make treaties" is the translation of the Latin inscription *Miscerique Probat Populos et Fœdera Jungi.*

363. Turks and Caicos Islands Badge.—With its three-masted ship under full sail, two salt piles, three baskets, and a native in a red jacket, the badge of these islands forms an interesting conception. It is used on the Blue Ensign.

364. Windward Islands Badge.—This badge is used as reproduced, with the addition of the laurel wreath, on the Union Flag. "Go on a lucky foot" is the literal translation of the inscription *I Pede Fausto* on the scroll.

365. New South Wales Badge.—The cross on the badge of New South Wales is taken from the first quarter of the arms of Australia. It is worn on the Blue Ensign as illustrated.

366. Queensland Badge.—This badge, with its blue Maltese Cross charged in the center with an Imperial Crown in full color, is taken from the third quarter of the arms of Australia.

367. South Australia Badge.—The bird on the badge of South Australia shows a representation in black and white of the Australian piping shrike standing on a perch of red and green.

368. Victoria Badge.—The five white stars on this badge represent the constellation of the Southern Cross. The Imperial Crown above them typifies royal authority.

369. Western Australia Badge.—The black swan, first discovered on Western Australia's principal river, mounted on a yellow circle, constitutes the badge of Western Australia.

370. Territory of Papua Badge.—The only note of color in this badge is the Imperial Crown in the upper section of the white disk.

371. Tasmania Badge.—This badge is taken from the sixth quarter of the arms of Australia. Its passant red lion with protruding tongue and letter "S" tail represents an interesting heraldic device.

372. Fiji Islands Badge.—The badge of the Fiji Islands is used as shown on the Blue Ensign. On the Union Flag it is superimposed upon the usual white disk and surrounded by the regulation laurel garland. The badge represents the full coat of arms which was granted in 1908. A free translation of the Fijian motto, *Rere Vaka na Kalou ka doka na Tui,* on the scroll is, "Fear God and Honor the King."

373. New Hebrides Badge.—The badge of the New Hebrides is worn on the Union Flag as illustrated. On the Blue Ensign a simple black line takes the place of the laurel wreath.

374. Western Pacific High Commissioner's Badge.—This badge is worn on the Union Flag with the usual laurel wreath.

375. Western Samoa Badge.—This badge is used on both the Blue and the Red Ensigns as shown, and on the Union Flag with the laurel wreath.

376. Straits Settlements Badge.—The badge of the Straits Settlements consists of a red lozenge with a three-armed field of white upon which rest three Imperial Crowns in full color. On the Blue Ensign this device appears without a background, but on the Union Flag it is superimposed on the regulation white disk and is bordered by the official laurel wreath of the Empire.

377. Ceylon Badge.—On the Union Flag the badge of Ceylon shows up strikingly, where it is used as shown, with the official laurel garland. On the Blue Ensign it is not so conspicuous but is used as shown.

378. Hong Kong Badge.—The Chinese

434 AFGHANISTAN

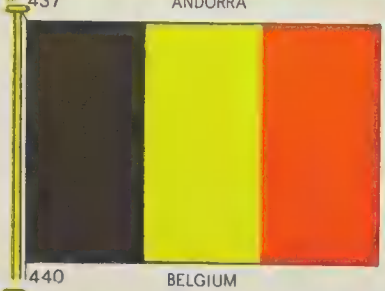
435 ALBANIA–MERCHANT

436 ALBANIA–NATIONAL

437 ANDORRA

438 ARGENTINA–ENSIGN

439 AUSTRIA


440 BELGIUM

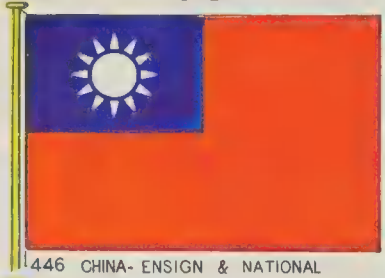
441 CONGO FREE STATE

442 BOLIVIA– ENSIGN

443 BRAZIL

444 BULGARIA– ENSIGN

445 CHILE


446 CHINA– ENSIGN & NATIONAL

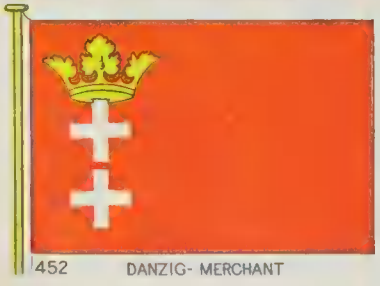
447 CHINA– MERCHANT

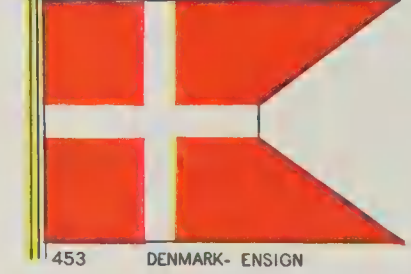
448 COLOMBIA– MERCHANT

449 COSTA RICA – ENSIGN

450 CUBA

451 CZECHOSLOVAKIA


452 DANZIG– MERCHANT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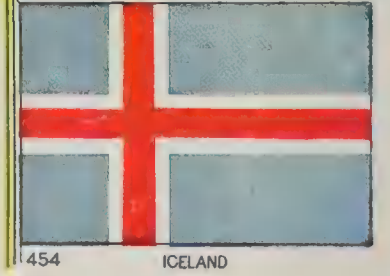
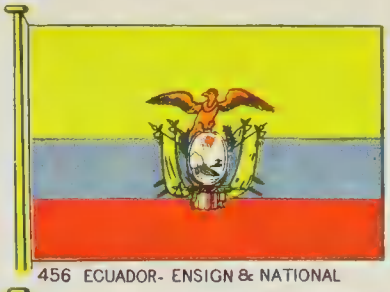
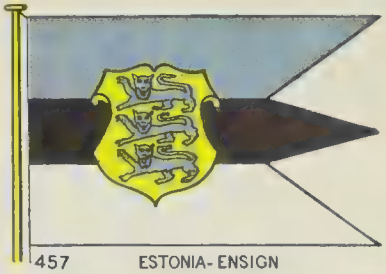

454 ICELAND

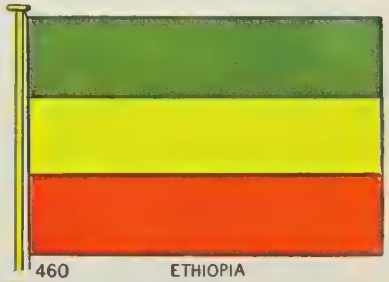
455 DOMINICAN REPUBLIC- ENSIGN


456 ECUADOR- ENSIGN & NATIONAL


457 ESTONIA- ENSIGN

458 EGYPT-ROYAL STANDARD AFLOAT

459 EGYPT- MERCHANT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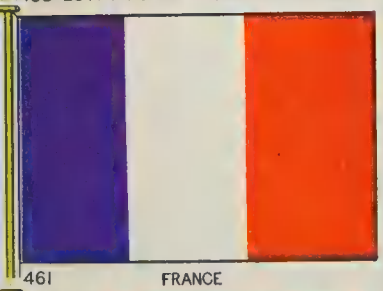
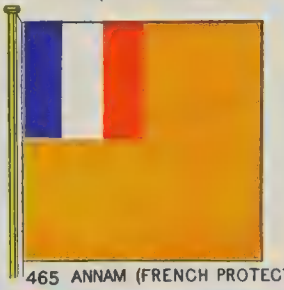

461 FRANCE

462 SYRIA (FRENCH MANDATE)

463 TUNISIA (FRENCH PROTECTORATE)

464 MOROCCO- MERCHANT (FRENCH)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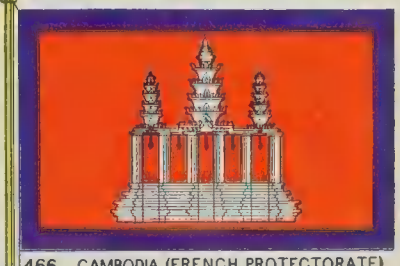
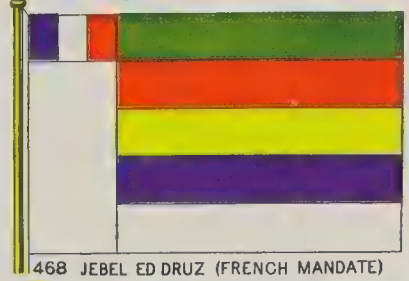
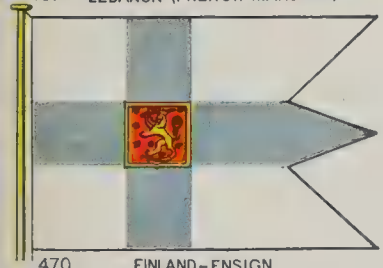
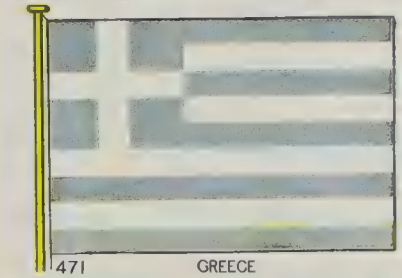

466 CAMBODIA (FRENCH PROTECTORATE)

467 LEBANON (FRENCH MANDATE)


468 JEBEL ED DRUZ (FRENCH MANDATE)

469 LATAKIA (FRENCH MANDATE)


470 FINLAND- ENSIGN


471 GREECE

472 GUATEMALA- ENSIGN & NATIONAL

473 GERMANY- MERCHANT

474 GERMANY- SWASTIKA

475 GERMANY- NAVAL ENSIGN & JACK

NATIONAL FLAGS OF THE WORLD

greeting the European in the foreground is said to be Tai Lo, the famous guide in the early days of the British occupation. The name Hong Kong means "Fragrant Waters." The badge of Hong Kong is worn on the Blue Ensign as pictured and on the Union Flag with the surrounding laurel wreath.

379. Labuan Badge.—The badge of Labuan has become more historic than current since the incorporation of that colony in the Straits Settlements.

380. Mauritius Badge.—The badge of Mauritius represents the full arms granted in 1906. The supports are a dodo and a sambar deer. On the Blue Ensign the badge appears as illustrated, but on the Union Flag it is imposed upon a white background encircled by the laurel wreath of the Empire. The inscription on the scroll of the badge is *Stella Clavisque Maris Indici,* which has been translated "A star and a key of the sea for a sign."

381. Seychelles Badge.—The badge of Seychelles, with its contrasting colors and its tortoise, appears on the Blue Ensign as illustrated, and on the Union Flag with the addition of the official laurel wreath. *Finis Coronat Opus* is the motto on the badge, which tells us that "The end crowns the work."

382. Weihaiwei Badge.—Weihaiwei is no longer a British possession, having been receded to China in 1930, but the badge is shown here for its historic significance as representing Great Britain's fine gesture in the direction of reconciliation in the Far East.

383, 384, 385, 386, 387, 388, 389, 391, 392, 393, 394, 396. Badges of Native Indian States.—These badges represent native States of India and are used on the Red Ensign as shown.

390. Malacca Badge.—Malacca is one of the oldest European settlements in the East. Along with Singapore (395) and Wellesley (397) it constitutes a part of the Crown Colony known as the Straits Settlements.

398. Gambia Badge.—The badge of Gambia is used on the Blue Ensign as shown, and on the Union Flag with the laurel wreath surrounding it.

399. Gold Coast Badge.—The only difference between the badge of Gambia and that of the Gold Coast is that the one shows the letter G. beneath the elephant and the other the letters G. C. The affixture of the two badges on the Union Flag and Blue Ensign follows identical practice.

400. Kenya Badge.—Kenya displays a red lion rampant guardant on its badge. It is used as illustrated on the Blue Ensign, and on the Union Flag it is displayed on a circular white disk and surrounded with the regulation laurel wreath.

401. Nigeria Badge.—Nigeria uses as its badge a red disk upon which are interlaced triangles in the form of a 6-pointed Solomon's seal. In the center of the seal is a laurel crown. The badge is used on the Union Flag enclosed in the regulation laurel wreath, and on the Blue Ensign as shown.

402. Northern Rhodesia Badge.—This badge was created after the British South African Company ceased to administer Northern Rhodesia in March, 1932. The yellow eagle holding a white fish is symbolical of the fauna of the country, and the white wavy pallets or lines constitute a conventional heraldic representation of white foaming water flowing over black rocks, symbolizing the Victoria Falls on the Zambezi River. This badge is worn on the Union Flag with the white circular disk and laurel wreath, and on the Blue Ensign as illustrated.

403. Nyasaland Badge.—Nyasaland uses the arms assigned to her in 1924 for her badge. On the Union Flag this badge surmounts the regulation white circular disk and is surrounded by the imperial laurel garland. On the Blue Ensign it is used as illustrated.

404. St. Helena Badge.—The ship on the St. Helena badge is supposed to be sailing between two cliffs. The badge is worn as illustrated on the Blue Ensign, and on the Union Flag with the white background and garland.

405. Sierra Leone Badge.—The badge of Sierra Leone, with its combined crosses of St. George and St. Andrew, its liberated slave, and its palm tree, is used as illustrated on the Blue Ensign, and with a surrounding laurel wreath on the Union Flag. The inscription under the shield reads *Auspice Britannia Liber,* which may be translated as "Free under the protection of Britain."

406. Somaliland Badge.—The Somaliland badge shows the head and shoulders of a koodoo, a member of the antelope family. It is used as shown on the Blue and Red Ensigns, and with a surrounding garland on the Union Flag.

407. Southern Rhodesia Badge.—This badge, with its golden pick symbolizing the mining industry, and its passant red lion between two thistles taken from the arms of the Rhodes family, was granted by Royal Warrant in 1924. It is used as illustrated on the Blue Ensign and with the white disk and laurel wreath on the Union Flag.

408. Tanganyika Badge.—The giraffe's head which constitutes the badge of Tanganyika Territory is used as shown on the Red Ensign, with the surrounding garland on the Union Flag, and without the white disk on the Blue Ensign.

409. Uganda Badge.—The bird on the Uganda badge is the African Balearic crane. It is used as shown on the Blue Ensign, and with the laurel wreath on the Union Flag.

410. Zanzibar Badge.—The badge of Zanzibar has a dhow or Arab ship at sea, flying a red flag at the stern. It is used by the British Resident on the Union Flag, as shown, with a garland surrounding it.

411. Alderney Badge.—The badge of Alderney is used on the Union Flag with surrounding garland.

412. Cyprus Badge.—Two red lions constitute the badge of Cyprus. This badge is used on the Red Ensign as illustrated, on the Union Flag with the laurel wreath added, and on the Blue Ensign without the white background.

413. Gibraltar Badge.—The badge of Gibraltar is used as illustrated on the Blue Ensign, and on the Union Flag it is placed upon the white circular disk surrounded with the laurel wreath. The inscription on the badge of Gibraltar carries us back to the time when that great rock was known as Mons Calpe. It reads *Montis Insignia Calpe,* or "The badge of Mount Calpe."

414. Guernsey Badge.—The Guernsey badge is used as illustrated, in an enclosed laurel wreath, on the Union Flag.

415. Isle of Man Badge.—The three armored legs on the badge of the Isle of Man are supposed to have been introduced by King Alexander of Scotland in the 13th century. There is a theory that the legs are intended to represent the sun running his course through the heavens. The badge is worn on the Union Flag as shown, with an encircling garland.

416. Jersey Badge.—The badge of Jersey, in its design, follows that of Guernsey, except that the latter has a sprig of golden leaves. It is used on the Union Flag as shown, with the regulation laurel garland encircling it.

417. Malta Badge.—The badge of Malta is a simple shield used as illustrated on the Blue Ensign. On the Union Flag it is imposed upon a white circular disk and surrounded with the laurel wreath of the Empire.

418. Badge of the Governor of Northern Ireland.—The Governor of Northern Ireland flies the Union Flag, at the intersection of whose crosses is placed his badge as shown. The Blue Ensign of Northern Ireland bears a white circle on the fly, upon which is imposed the plain letters G. N. I.

419. Palestine Badge.—The badge of Palestine heretofore consisted of a plain white circle upon which occurred the word "Palestine." Since the plate went to press, a new badge has been adopted which shows a castle set on a hill.

420. Union Flag Wreath.—This wreath made up of laurel leaves and berries is the device with which all badges are surrounded when placed upon the intersection of the crosses of the Union Flag of the British Empire to betoken the presence of the appropriate representatives of the Empire when this flag is displayed. There are only a few instances in which the wreath used departs from the regulation form. These exceptions include the Governor's Badge of Northern Ireland (418), the Governor's Badge of New Zealand (338), and the Governor's Badge of Australia (337).

421. Tonga—State Flag.—The State Flag of Tonga, or the Friendly Islands, a British protectorate, is flown on March 13, the birthday of Queen Salote, who was born in 1900, and on October 11, the coronation day of the Queen, who was crowned in 1917.

422. Sarawak—Merchant.—The merchant ships of Sarawak, whose present Rajah is Sir Charles Vyner Brooke, fly this striking combination of yellow, red, and black.

423. Federated Malay States—Ensign.—The Ensign of the Federated Malay States has bars of white, red, yellow, and black, representing the States of Perak, Selangor, Negri Sembilan, and Pahang, which compose the Federation. These States are in the Malay Peninsula and under British protection.

424. Pahang—Ensign.—In this flag, adopted December 28, 1903, the white is supposed to represent the Sultan, the black the Dato Bendahara and the Raayats who are faithful to and dependent upon the Sultan.

425. Negri Sembilan—Ensign.—In the Negri Sembilan Ensign the red stands for the Government, yellow for the Rajah, and black for the Undang, who are important territorial chieftains in Negri Sembilan.

426. Perak—Ensign.—In this Ensign, white stands for the Yang di-Pertuan, yellow for the Rajamuda, and black for the Bendahara, these being the three chief officers of the State.

427. Selangor—Ensign.—The four quarters of this flag indicate the union of four districts which were previously independent under one Sultan. The colors are said to represent the blood relationship which binds the people of the four districts together, and the yellow crescent and star symbolize the light which guides the destiny of the State.

428. Kelantan—State Flag.—The Malay States not included in the Federation are five in number—Johore, Kedah, Perlis, Kelantan, and Trengganu. The State Flag of Kelantan, with its white crescent moon, two lances, two krises, and a five-pointed star, is solid red, a color which symbolizes the people of the State, while the white in the device signifies the Sultan. The lances and krises are national weapons of the Malays.

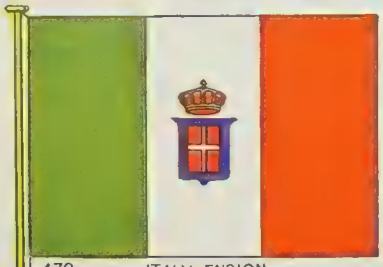
429. Perlis—State Flag.—The yellow in the State Flag of Perlis is the Rajah's color. The date of the adoption of this flag is unknown, but is said to have been in the reign of Syed Safi, father of the present Rajah.

430. Johore—National Flag.—The Maharaja Abu-Bakar is supposed to have brought

476 HAITI-ENSIGN

477 HONDURAS-ENSIGN

478 HUNGARY-NATIONAL & MERCHANT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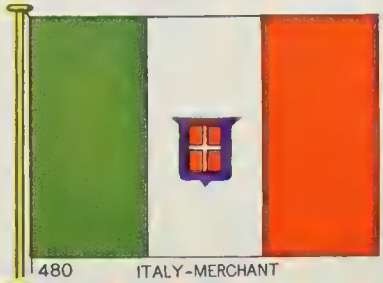
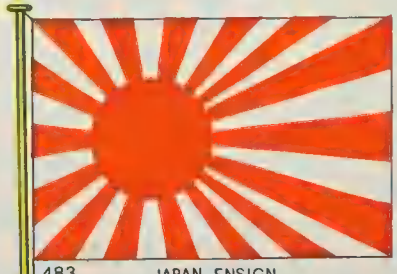
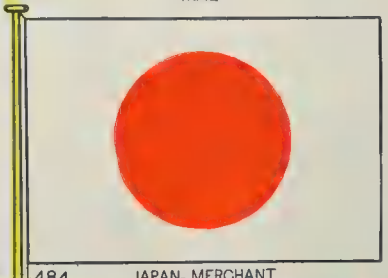
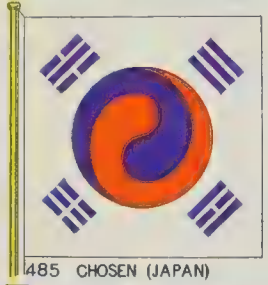

480 ITALY-MERCHANT

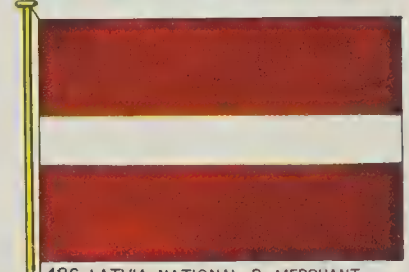
481 IRAQ

482 JAPAN-EMPEROR'S STANDARD


483 JAPAN-ENSIGN


484 JAPAN-MERCHANT


485 CHOSEN (JAPAN)

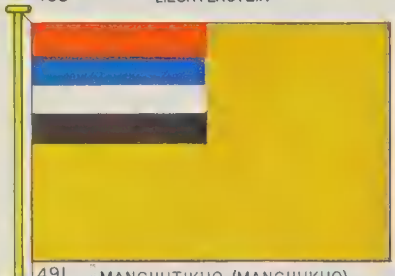

486 LATVIA-NATIONAL & MERCHANT

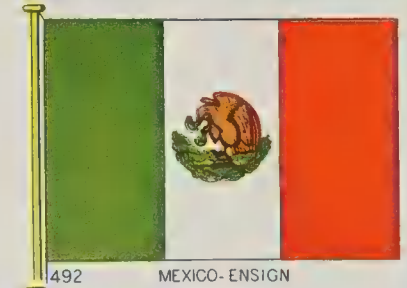
487 LIBERIA

488 LIECHTENSTEIN

489 LITHUANIA-ENSIGN

490 LUXEMBOURG


491 MANCHUTIKUO (MANCHUKUO)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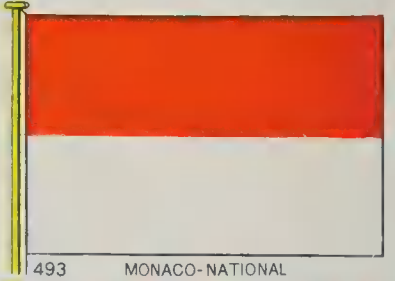
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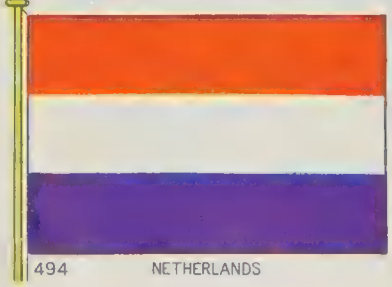
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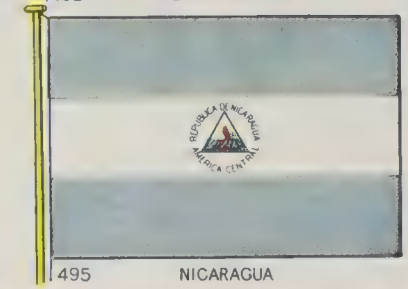

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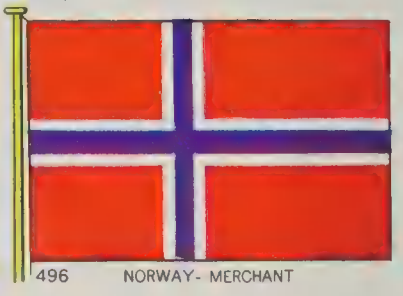
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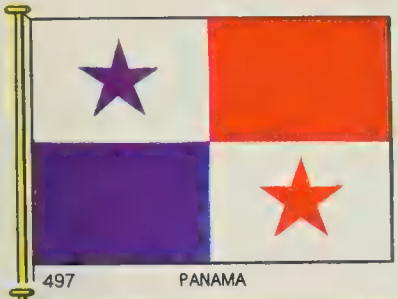
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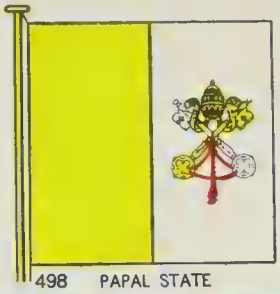
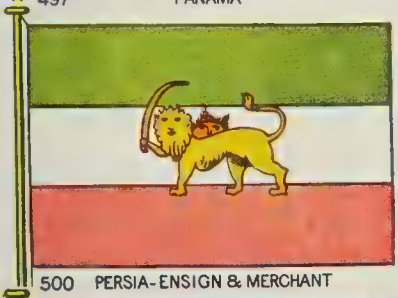
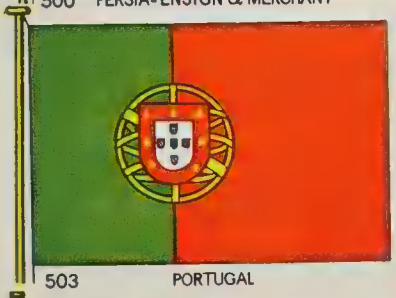

498 PAPAL STATE

499 PARAGUAY


500 PERSIA - ENSIGN & MERCHANT

501 PERU - ENSIGN & NATIONAL

502 POLAND - MERCHANT


503 PORTUGAL

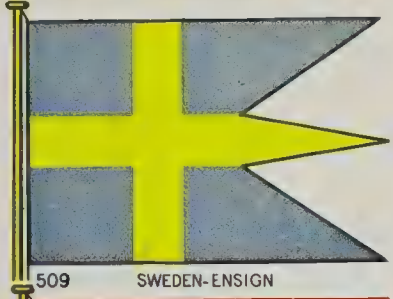
504 ROMANIA - ENSIGN & NATIONAL

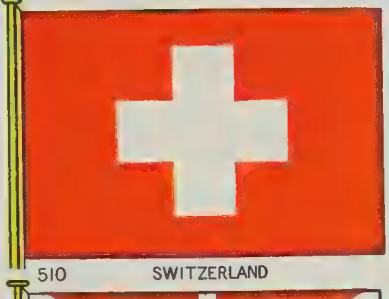
505 SALVADOR - ENSIGN & NATIONAL

506 SAN MARINO

507 SIAM - ENSIGN

508 SPAIN - ENSIGN & NATIONAL


509 SWEDEN - ENSIGN


510 SWITZERLAND

511 TIBET

512 TURKEY

513 U.S.S.R. - ENSIGN

514 U.S.S.R. - NATIONAL & MERCHANT

515 URUGUAY

516 VENEZUELA - ENSIGN

517 YUGOSLAVIA

this flag into use in 1871. White is the Sovereign's color, red the color of the Heir Apparent, and blue symbolizes the Universe.

431. KEDAH—NATIONAL FLAG.—The present flag of Kedah was adopted in 1912. Red is the color of the State, yellow the Sultan's color, and green the color of the President of the State Council. The crescent moon denotes Islam.

432. TRENGGANU—NATIONAL FLAG.—The National Flag of Trengganu, with its white and black, was adopted in 1925. It is said that white is the Sultan's color and black the color of the people.

433. BRUNEI—NATIONAL FLAG.—The Sultan of Brunei, who occupies the northwest coast of Borneo, flies this striking flag. Yellow is the color of the Sultan, white that of the Chief Minister of State, the Duli Pengiran Bendahara, and the black represents the Second Minister, the Duli Pengiran Pemancha.

FLAGS OF MANY NATIONS

434. AFGHANISTAN.—The device on the National Flag of Afghanistan is an oriental open mosque showing a pulpit and mihrab (prayer niche) and a flag on its staff attached to each side of the plinth of the mosque. This flag has only recently superseded a solid black one with a device in white. The colors are said to signify progress, sacrifice, and prosperity.

435. ALBANIA—MERCHANT.—The Merchant Flag of Albania is formed of three equal horizontal bars, upper and lower deep red, and the other black.

436. ALBANIA—NATIONAL.—The National Flag of Albania carries the black double-headed eagle of Skanderbeg, the great 15th-century patriot of the country. The old Albanian tradition is that the Albanians are descendants of an eagle.

437. ANDORRA.—The flag of the vest-pocket Republic of Andorra carries a conventionalized crown on its yellow stripe.

438. ARGENTINA—ENSIGN.—The National Ensign and National Flag of Argentina carries a golden sun in its central stripe. The Merchant Flag lacks the golden sun.

439. AUSTRIA.—The Austrian flag is made up of three bars, two red and one white. These colors are supposed to have originated with the Babenberg dynasty. It is related that Leopold of Babenberg, a famous Crusader of the 12th century, found when returning from a battle that his white cloak was red with blood except for the part protected by his belt, and thereupon decided to adopt its colors for his own.

440. BELGIUM.—The colors of the Belgian flag are taken from the arms of Brabant, the yellow from the lion, the red from his tongue, and the black from the shield.

441. CONGO FREE STATE (BELGIAN CONGO).—Although the Congo Free State has long since become part and parcel of the Belgian Congo, the Belgian Government still permits it to fly its flag except on official occasions.

442. BOLIVIA — ENSIGN. — The Ensign of Bolivia carries the arms of the country. The first Bolivian flag was adopted at Sucre in 1825.

443. BRAZIL.—The flag of Brazil covers all purposes, whether National, Ensign, or Merchant. The letters on the device are *Ordem E Progresso*. Translated, this means "Order and Progress." The 21 white stars on the blue sphere represent the States of Brazil, the largest one representing the Federal District of Rio de Janeiro. The green symbolizes the fields and forests of Brazil; the yellow its wealth in precious minerals; and the blue the azure of the country's sky.

444. BULGARIA—ENSIGN.—The Ensign of Bulgaria shows a yellow crowned lion rampant on a square red canton. The colors of the flag are white, green, and red.

445. CHILE.—Chile has but one flag. It serves as National, Military, and Merchant Flag. It was designed by Don José Ignacio Zenteno and adopted in 1817. The white is said to symbolize the snow of the Andes, the blue the color of the sky, and the red the blood shed by Chilean patriots in their War of Independence.

446. CHINA—ENSIGN AND NATIONAL.—The flag has a red field, blue canton, and a white sun. It was officially adopted in December, 1928.

447. CHINA—MERCHANT. — The Merchant Flag of China is the same as the Ensign and National Flag with the addition of four wavy yellow stripes vandyked across the field of the flag.

448. COLOMBIA—MERCHANT.—The National Flag of Colombia is unadorned with any device. The Merchant Flag carries in its center an oval enclosed in red upon which is imposed a white star. The Ensign of Colombia carries the coat of arms of the country.

449. COSTA RICA—ENSIGN.—The three volcanoes on the coat of arms are Turrialba, Irazú, and Poas. It is supposed to show two oceans, the Atlantic and the Pacific; the stars represent the five original provinces; the two ships indicate the mercantile interest of the State. The Merchant and National Flags are the same as the Ensign without the imposition of the coat of arms.

450. CUBA.—Cuba's lone star flag serves alike as Ensign, National, and Merchant. It is reputed to have been created by the Cuban patriots, Narciso López and his comrade, Miguel Tuerbe Tolón.

451. CZECHOSLOVAKIA.—The Czechoslovakian flag was established by law March 30, 1920. The red and white colors are those of the Kingdom of Bohemia and the blue that of Moravia.

452. Danzig—Merchant.—The device on the flag of Danzig is supposed to have been taken from two sources. The crosses trace back to the Teutonic Knights and the golden crown to the one granted to Danzig by Casimir the Jagiellonian, King of Poland.

453. Denmark — Ensign. — The "Dannebrog," the flag of Denmark, is reputed to be the oldest in use in the world. According to tradition, it fell from heaven during the Battle of Lindanissa (now Tallinn) on June 15, 1219, when Valdemar II of Denmark defeated the Estonians.

454. Iceland.—Iceland secured the right to have a distinctive flag of her own by a Danish Royal Decree of November 22, 1913. The design recommended was approved June 19, 1915. When Iceland became an independent State in 1918, she continued to use that flag.

455. Dominican Republic—Ensign.—The flag of the Dominican Republic was hoisted by the founders in 1844. The red cantons symbolize the blood and the fire through which they marched to liberty. The white cross is symbolic of the sacrifice which the population would make before losing its freedom.

456. Ecuador—Ensign and National.—The plain tricolor of Ecuador is the Merchant Flag. The Ensign and National Flag carries the coat of arms. It was not until 1829 that Ecuador and Colombia separated; so their earlier flag history is the same.

457. Estonia—Ensign.—The colors of Estonia, blue, black, and white, were first adopted by Estonian students on the foundation of the first Estonian Students' Association, September 17, 1881. The difference between the Ensign on the one hand and the National and Merchant Flags on the other lies in the fact that the Ensign is swallow-tailed with a tongue, whereas the National and Merchant Flags are rectangular; also the Ensign carries on a yellow shield three blue lions.

458. Egypt—Royal Standard Afloat.—The Kingdom has two standards, one for sea, the other for land usage. In the center are the Royal Arms on a pavilion which is ensigned with the Royal Crown. There are also crowns in the several corners of the standard. The colors encircling the arms are those of the Order of Mohammed Ali.

459. Egypt—Merchant.—When Egypt became free from Turkey, she abandoned the latter's flag and substituted one with a green field. The National Flag does not have the anchor, and the Ensign uses two crossed anchors.

460. Ethiopia.—The flag of Ethiopia, hitherto known as Abyssinia, has been used in its present form since about 1894, although Abyssinia is one of the oldest States in the world. The Ethiopians say that the green indicates the fertility of the land, the yellow their zeal for their country, and the red the blood they would shed in its defense.

461. France.—The Tricolor of France traces its origin back to Clovis. After the Battle of Tolbiac (Zülpich), 496 A. D., Clovis adopted the blue cope of St. Martin as his banner. From about the 11th century until the Battle of Agincourt, 1415 A. D., the oriflamme or red flag of St. Denis became the banner of the French. The banner of the Bourbons was white. The Tricolor was first used in 1789 and reached its present form in 1830.

462. Syria (French Mandate).—This flag was first officially hoisted in Damascus (Damas) on June 11, 1932, but it had previously been flown in Aleppo (Alep), January 1, 1932. The late King Feisal, when becoming King of Syria in 1920, unfurled a Hashimite banner of which the present flag is a modification. The green represents the Omayyad caliphates, the white stands for the Abbasside dynasty, and the black proclaims the early Islamic era. The three vilayets of Damascus, Aleppo, and Deir ez Zor are supposed to be represented by the three stars.

463. Tunisia (French Protectorate).—From the beginning of the fourth century before Christ, certain Tunisian ports used the globe within the arms of a crescent. A story goes that on the night Constantinople fell a star appeared in the crescent of the moon, and this became a sign of the conqueror.

464. Morocco—Merchant (French).—This red flag carries a green Solomon's seal. The Arabs gave the name of Solomon's seal to the starlike figure engraved on the bottom of their drinking cups. In another form it is the pentacle or Druid's foot which is supposed to possess the power of banishing demons.

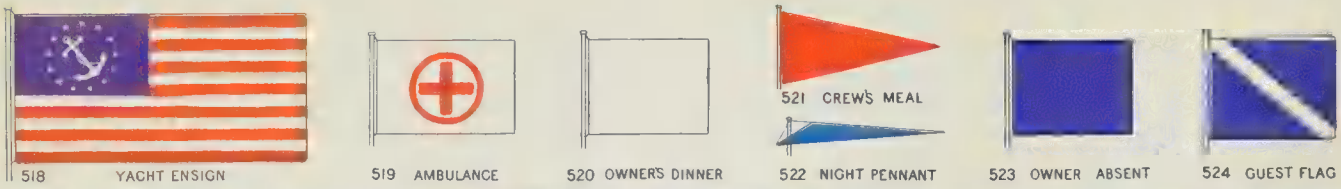
465. Annam (French Protectorate).—This orange flag carries the French Tricolor in its canton.

466. Cambodia (French Protectorate).—The flag of Cambodia with its triple-towered oriental temple is one of the striking flags of the East.

467. Lebanon (French Mandate).—The flag of Lebanon is the French Tricolor with a conventionalized representation of a cedar of Lebanon on the white stripe. The Tricolor indicates the control of France, and the cedar speaks for Lebanon.

468. Jebel ed Druz (French Mandate).—With its five equal horizontal bars, its French Tricolor in the canton, and its white vertical bar next to the flagstaff, the flag of Jebel ed Druz is one of the most colorful banners of the East.

469. Latakia (French Mandate).—The people of Latakia are divided into two main branches, the Shamsiyehs and the Amriyehs. The Shamsiyehs venerate the sun and the Amriyehs the moon. The former, being the more

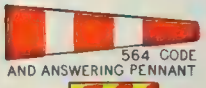


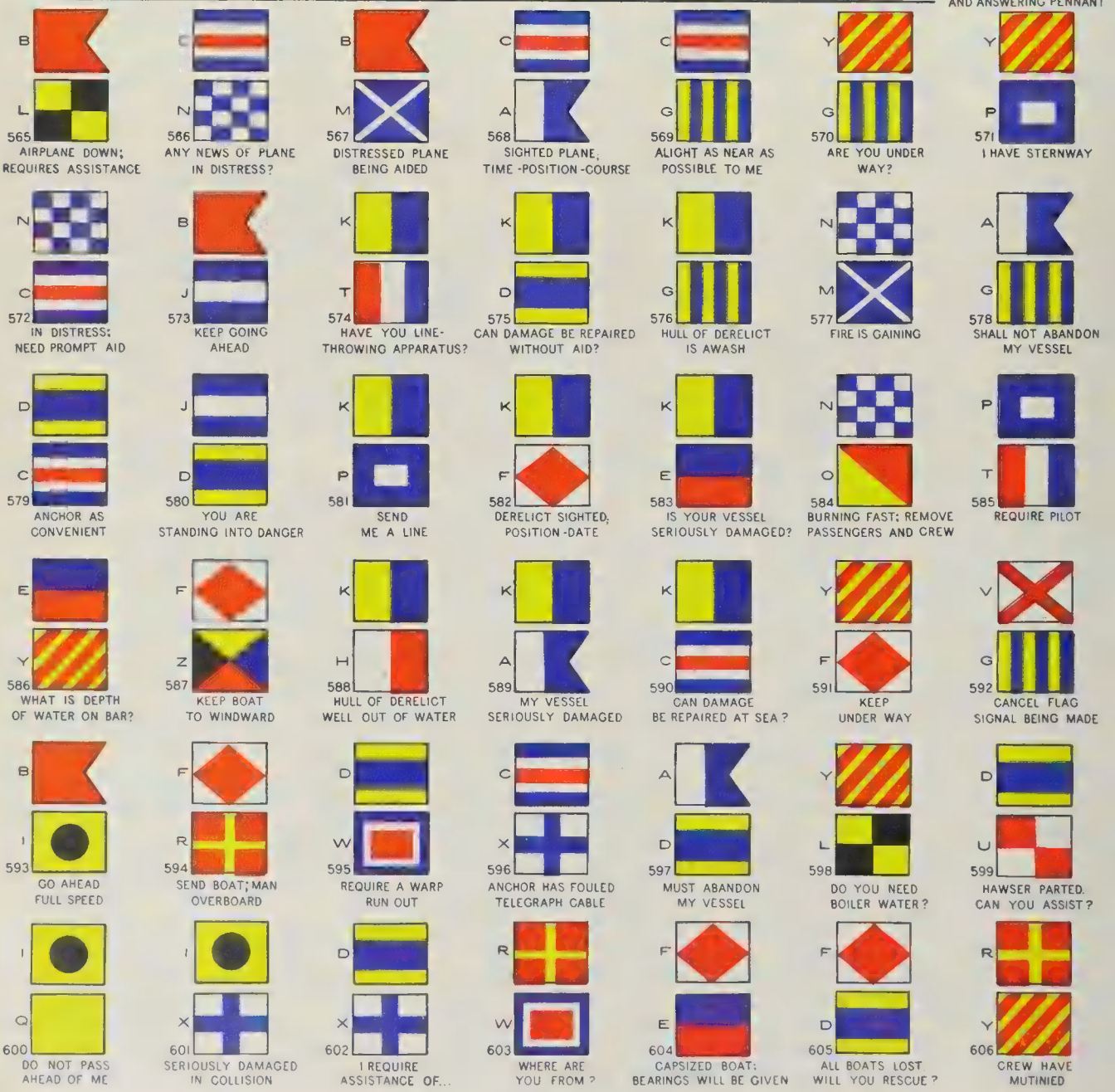
AMERICAN YACHT FLAGS

ALPHABET

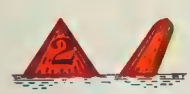
NUMBERS

INTERNATIONAL CODE FLAGS AND PENNANTS



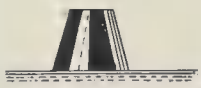

565 AIRPLANE DOWN; REQUIRES ASSISTANCE
566 ANY NEWS OF PLANE IN DISTRESS?
567 DISTRESSED PLANE BEING AIDED
568 SIGHTED PLANE; TIME-POSITION-COURSE
569 ALIGHT AS NEAR AS POSSIBLE TO ME
570 ARE YOU UNDER WAY?
571 I HAVE STERNWAY
572 IN DISTRESS; NEED PROMPT AID
573 KEEP GOING AHEAD
574 HAVE YOU LINE-THROWING APPARATUS?
575 CAN DAMAGE BE REPAIRED WITHOUT AID?
576 HULL OF DERELICT IS AWASH
577 FIRE IS GAINING
578 SHALL NOT ABANDON MY VESSEL
579 ANCHOR AS CONVENIENT
580 YOU ARE STANDING INTO DANGER
581 SEND ME A LINE
582 DERELICT SIGHTED; POSITION-DATE
583 IS YOUR VESSEL SERIOUSLY DAMAGED?
584 BURNING FAST; REMOVE PASSENGERS AND CREW
585 REQUIRE PILOT
586 WHAT IS DEPTH OF WATER ON BAR?
587 KEEP BOAT TO WINDWARD
588 HULL OF DERELICT WELL OUT OF WATER
589 MY VESSEL SERIOUSLY DAMAGED
590 CAN DAMAGE BE REPAIRED AT SEA?
591 KEEP UNDER WAY
592 CANCEL FLAG SIGNAL BEING MADE
593 GO AHEAD FULL SPEED
594 SEND BOAT; MAN OVERBOARD
595 REQUIRE A WARP RUN OUT
596 ANCHOR HAS FOULED TELEGRAPH CABLE
597 MUST ABANDON MY VESSEL
598 DO YOU NEED BOILER WATER?
599 HAWSER PARTED. CAN YOU ASSIST?
600 DO NOT PASS AHEAD OF ME
601 SERIOUSLY DAMAGED IN COLLISION
602 I REQUIRE ASSISTANCE OF...
603 WHERE ARE YOU FROM?
604 CAPSIZED BOAT; BEARINGS WILL BE GIVEN
605 ALL BOATS LOST WILL YOU RESCUE?
606 CREW HAVE MUTINIED

INTERNATIONAL FLAG SIGNALS


607 INBOUND STARBOARD CHANNEL MARKERS

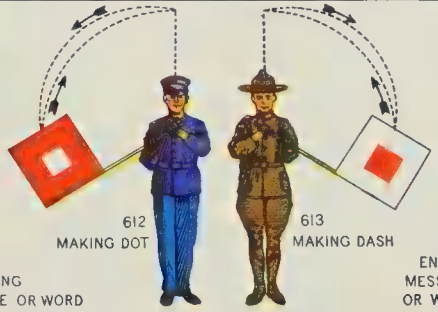
608 INBOUND PORT CHANNEL MARKERS

609 OBSTRUCTION MARKER


610 MID-CHANNEL BUOY

U.S. BUOYS AND SPARS

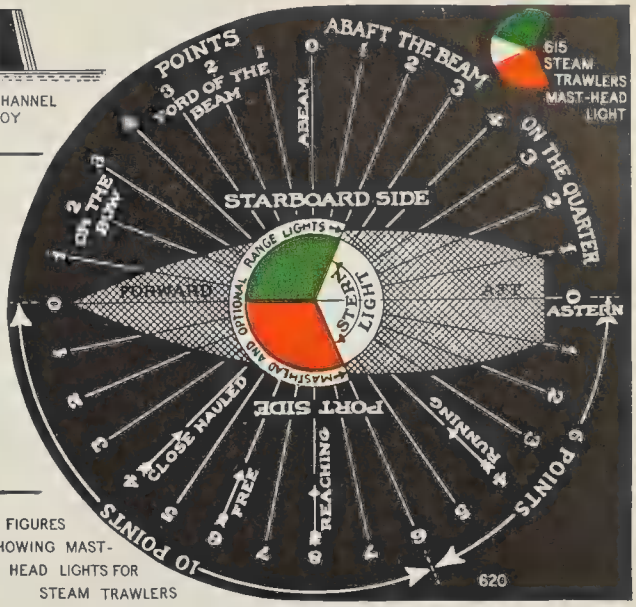
611 BEGINNING MESSAGE OR WORD


612 MAKING DOT

613 MAKING DASH

614 ENDING MESSAGE OR WORD

WIGWAG FLAGS IN USE

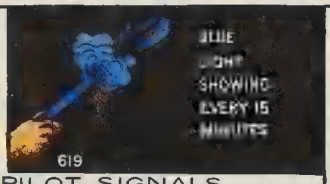


FIGURES SHOWING MAST-HEAD LIGHTS FOR STEAM TRAWLERS AND ANGLES COVERED BY RUNNING AND OTHER LIGHTS OF STEAM VESSELS

JACK AT FORE 616

617

618



619

DAY AND NIGHT PILOT SIGNALS

INVERTED ENSIGN 621

622

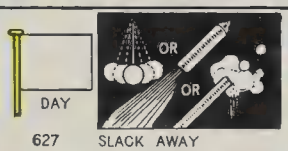
623

624 TRACTOR-DRAWN LIFE BOAT FOR ANSWERING DISTRESS SIGNALS

DAY AND NIGHT DISTRESS SIGNALS

625 AID WILL BE GIVEN

626 HAUL AWAY

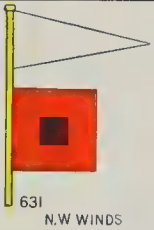

627 SLACK AWAY

628 DON'T LAND OWN BOATS

629 LAND HERE

LIFE-SAVING SIGNALS

630 S.W. WINDS


631 N.W WINDS

632 N.E. WINDS

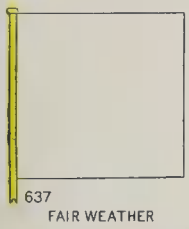
633 S.E. WINDS

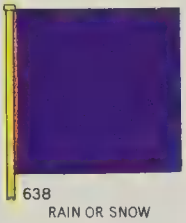
634 HURRICANE WARNING

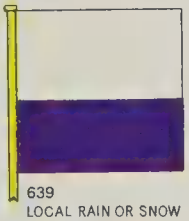
635 SMALL CRAFT

636 NIGHT SIGNALS

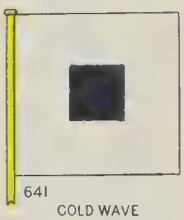
STORM WARNINGS


637 FAIR WEATHER


638 RAIN OR SNOW


639 LOCAL RAIN OR SNOW

640 TEMPERATURE

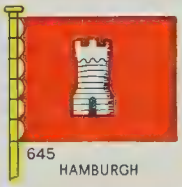

641 COLD WAVE

WEATHER FORECAST FLAGS

642 VENICE

643 FRENCH GALLEY

644 SAVOY

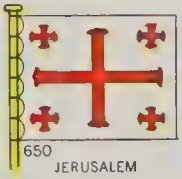

645 HAMBURGH

646 LUBECK

647 BREMEN

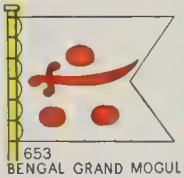
648 LUNENBURGH

649 OSTEND ENSIGN


650 JERUSALEM

651 MOCO ARABA

652 CZAR OF MOSCOVY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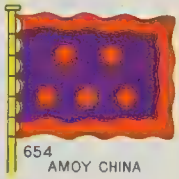
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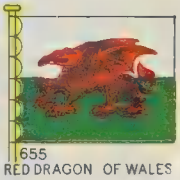

655 RED DRAGON OF WALES

WORLD FLAGS AT THE BEGINNING OF THE 18TH CENTURY

important of the two, have their symbol in the center of the National Flag.

470. FINLAND—ENSIGN.—The Merchant Flag differs from the Ensign in being rectangular, without the shield. The National Flag is rectangular, with the shield upon the intersection of the cross. Finland became an independent nation in 1917 and runs her government somewhat similarly to that of the United States.

471. GREECE.—The first Greek flag put into use in 1822 consisted of a white cross on a red field. There have been many changes since then, but there has always been a cross on the flag.

472. GUATEMALA—ENSIGN AND NATIONAL.—The Merchant Flag differs from the Ensign and National Flag only in the omission of the coat of arms with its green quetzal, bayoneted rifles, and crossed swords surmounted by a scroll.

473. GERMANY—MERCHANT.—Under decree of December 20, 1933, the German Government ordered that what is known as the black-white-red flag shall be flown at the stern on the flagstaff. The Swastika (474) must also be flown simultaneously at the jack staff, or if this is impossible, it is to be displayed at another suitable place corresponding to its dignity as a symbol of sovereignty.

474. GERMANY—SWASTIKA.—On March 12, 1933, Chancellor Hitler ordered that the black-white-red colors were to be hoisted together with the Hooked Cross (Swastika) throughout Germany, saying that "these Flags unite the glorious past of the German Reich with the vigor and rebirth of the German race. Let them fly together as a symbol of the power of the State and the internal unity of all national sections of the German people!"

475. GERMANY—NAVAL ENSIGN AND JACK.—When Chancellor Hitler issued his famous decree requiring the Swastika to be flown along with the black-white-red colors, he specifically exempted military buildings from that requirement, stating that they should fly their Reich War Flag only.

476. HAITI—ENSIGN.—It is said that when Jean Jacques Dessalines was marching on Port-au-Prince in 1803 he saw a French Tricolor in the native ranks. In order further to inflame the ardor of his legions of devoted slaves and freedmen, he took the Tricolor and tore out the white, saying that henceforth the Haitian flag should be bicolored, signifying the union of the blacks and the mulattoes in the cause of Haitian liberty. The arms of the country carried on the Ensign were put there by President Alexandre Sabès Pétion, who served from 1807 to 1818.

477. HONDURAS—ENSIGN.—The Ensign of Honduras carries the coat of arms of the country. The National and Merchant Flags are alike, with the five 5-pointed stars taking the place of the coat of arms of the Ensign. These five stars are placed on the flag of Honduras as a memorial to the ill-fated Central American Union from which Honduras seceded in 1839. The present flag was adopted in 1866.

478. HUNGARY—NATIONAL AND MERCHANT.—The flag of Hungary takes its colors from the Hungarian coat of arms. This coat of arms had its beginning in 1202. Its four white bands were supposed to symbolize the country's chief rivers, the Danube, the Theiss, the Drava, and the Sava.

479. ITALY—ENSIGN.—The arms on the Ensign and Merchant Flag of Italy are those of Savoy. The Ensign also carries a Royal Crown. The Italian flag first received recognition in 1796 when it was used by the Italian Legion under Napoleon. He adopted it as the National Flag when he made Italy a kingdom in 1805. After Napoleon's downfall in 1815, the flag was discontinued until 1848

480. ITALY—MERCHANT.—This is the flag flown by the new greyhounds of the sea—including the *Rex*—of the Italian Line. It is said that green was the favorite color of Napoleon, who incorporated it in the flag that has since become Italian.

481. IRAQ.—The two stars of the Iraq flag signify the two races of Iraq—Arabian and Kurd. The red trapezium shows the heraldic color of the Hashimites, to which King Ghazi belongs.

482. JAPAN—EMPEROR'S STANDARD.—The device on the Emperor's Standard is a conventionalized golden chrysanthemum of 16 rays. During the Civil War of 1868 the Imperial Army fought under the chrysanthemum flag, and it is out of this flag that the Imperial Standard evolved.

483. JAPAN—ENSIGN.—The Ensign has a ball in the inner two thirds of the flag, putting the full 16 rays to the edges of the flag—five to the bottom, five to the top, and three to each of the two sides. The device of the sun is supposed to be the image of the Imperial Ancestor. For this reason, the National Flag is an object of reverence and worship.

484. JAPAN—MERCHANT.—As the Land of the Rising Sun, Japanese merchant ships carry a plain red ball on a white field.

485. CHOSEN (JAPAN).—The circular device on the Chosen (Korean) flag is known as the *pa-kwa*. This symbol is supposed to represent any two complementary objects of Nature, such as male and female, or water and earth. The Japanese flag has latterly taken the place of the old flag of Korea in Chosen.

486. LATVIA.—In the 13th century an old German writer described the flag of the Letts who came to the aid of the Knights of the Castle of Cesis as being a red flag with a white stripe on it. Although for centuries under foreign rule, the Letts have at last come again under a flag of their own.

487. Liberia.—The Liberian flag was first hoisted August 24, 1847. The three colors signify the three divisions of the country when the flag was established. Its 11 stripes represent the 11 men who signed the Liberian Declaration of Independence. Its single star speaks of the unique character of the country.

488. Liechtenstein.—The flag of Liechtenstein is formed of two equal horizontal halves of royal red over blue. The country over which it flies is one of the smallest principalities in the world.

489. Lithuania — Ensign. — The double cross on the shield of the Lithuanian Ensign is said to be a symbol of endurance. It was first used in the 12th century.

490. Luxembourg.—The colors of the flag of Luxembourg are taken from the coat of arms of the ancient Duchy of Luxembourg.

491. Manchutikuo.—The flag of Manchutikuo (Manchukuo) is yellow, containing a canton with horizontal stripes of red, blue, white, and black. As the youngest in the galaxy of the world's banners, it has excited interest to the ends of the earth. Yellow is the color of the imperial house of the Emperor whose ancestors ruled all China. It is said that the yellow stands for Manchutikuo, the red for enthusiasm, the blue for youth, the white for impartiality, and the black for fortitude. Another interpretation of the flag of the new Empire says that the colors stand for the chief races in Manchutikuo—Manchu, Mongolian, Korean, Russian, and Chinese.

492. Mexico—Ensign. — The Ensign of Mexico is a tricolor of green, white, and red, with the arms of the country imposed upon the white section. The arms originated with the legend that the Aztecs could not settle until they found an eagle with a green serpent in its beak, standing on a cactus plant situated on an island in a lake.

493. Monaco — National. — Monaco gets the colors of its flag from those on the arms of the family of Grimaldi, Princes of Monaco. The shield of those arms is covered with red and white lozenges.

494. Netherlands.—The first flag of the Netherlands bore the colors of William of Orange, orange, white, and blue. In 1599 they were ordered to be three equal horizontal stripes. About the middle of the 17th century the orange appears to have been superseded by red, though it still shows up in the old flag of the Orange Free State. The present flag was adopted by Royal Decree in 1807.

495. Nicaragua.—The flag of Nicaragua is made up of three horizontal stripes, the middle one white and the others blue. The arms of the country, which bear five conical peaks surmounted by a liberty pole and cap, are imposed upon the white stripe.

496. Norway—Merchant.—With its blue, white-bordered cross on a field of red, the Merchant Flag of Norway no longer bears the union mark that until 1898 signified Norway's union with Sweden.

497. Panama.—Panama became a separate republic in 1903. Its flag was designed by Señor Manuel Amador, Jr., and was made by his mother. The original was hoisted over the Revolutionary Junta's general headquarters at the Central Hotel in Panamá, November 3, 1903, and a duplicate over the municipal palace by the Alcalde. The flag was formally adopted on December 20, 1903.

498. Papal State (Vatican City).—Two equal vertical stripes of yellow and white, charged with the insignia of the Papacy on the white stripe, a triple crown, or tiara, over two crossed keys, one of gold and one of silver, tied with a red cord and two tassels, constitute the flag of the Papal State.

499. Paraguay.—The flag of Paraguay shows a device on the obverse side consisting of a yellow 5-pointed star within two green branches, the left one bearing red berries. They are tied together with red, white, and blue ribbons. The device on the reverse side is a black-maned yellow lion in a sitting position, supporting a liberty pole and cap.

500. Persia—Ensign and Merchant.—Persia's flag is a tricolor of apple green, white, and pink. The figure is a standing lion holding a sword in its right forepaw. Beyond the lion is the rising sun.

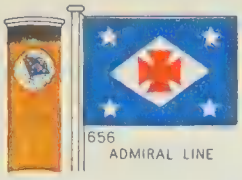
501. Peru — Ensign and National. — From the days of the Incas, Peru has had many flags. The one they hoist at present with the coat of arms of the country upon it was adopted by a special law in 1823, which was promulgated by Bolívar, sometimes referred to as "the George Washington of South America."

502. Poland—Merchant.—The Merchant flag of Poland is the National Flag of white over red with a white eagle displayed on a red field. Although Poland is a republic, it is interesting to note that the eagle still remains crowned.

503. Portugal.—Although Portugal is a republic, it still retains as the emblem of its flag the seven castles and five shields of the arms of the monarchy. The five blue shields commemorate the great victory of Alphonso I in 1139 over the five Moorish princes in the Battle of Ourique.

504. Romania—Ensign and National.—The blue, yellow, and red tricolor of Romania, with the Royal Arms in the yellow section, is the National Flag and Ensign. The Merchant Flag is merely the tricolor without any device imposed upon it. The Royal Arms include a blue shield bearing a yellow crowned eagle displayed grasping a scepter and sword with its talons. The new spelling of Romania is a tribute to the Roman ancestry of the Vlachs.

505. Salvador—Ensign and National.—


656 ADMIRAL LINE

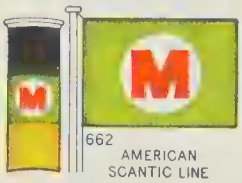
657 ALASKA S. S. CO.

658 AMERICAN EXPORT LINES

659 AMERICAN-HAWAIIAN LINE

660 AMERICAN MAIL LINE

661 AMERICAN MERCHANT LINES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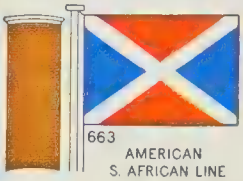
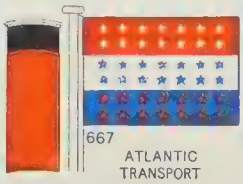

663 AMERICAN S. AFRICAN LINE

664 ANCHOR LINE

665 ARGONAUT LINE

666 ARNOLD BERNSTEIN LINE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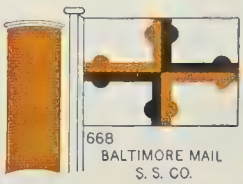
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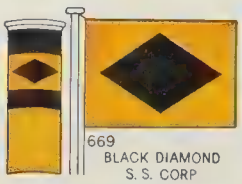
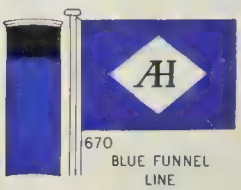

669 BLACK DIAMOND S. S. CORP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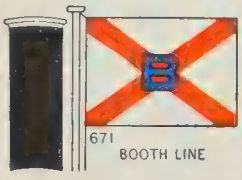
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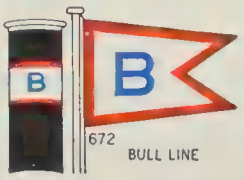
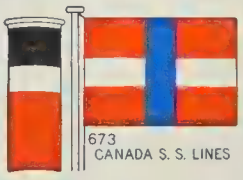
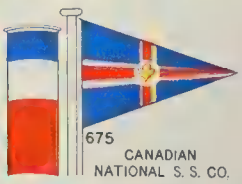
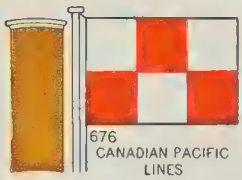

672 BULL LINE

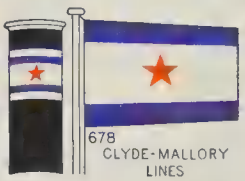

673 CANADA S. S. LINES

674 CANADIAN-AUSTRALASIAN LINE

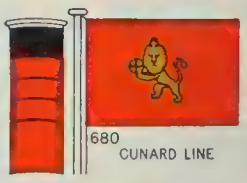

675 CANADIAN NATIONAL S. S. CO.


676 CANADIAN PACIFIC LINES

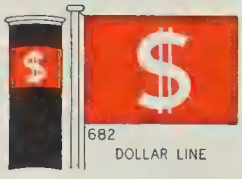
677 CHICAGO, DULUTH & GEORGIAN BAY


678 CLYDE-MALLORY LINES

679 COLOMBIAN LINE

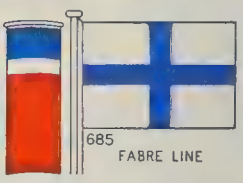

680 CUNARD LINE

681 DETROIT & CLEVELAND LINE


682 DOLLAR LINE

683 DONALDSON LINE

684 EASTERN S. S. LINES


685 FABRE LINE

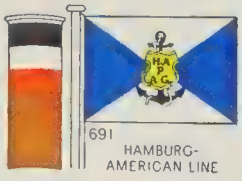
686 FRENCH LINE

687 FURNESS LINES

688 GRACE LINE

689 GREAT LAKES TRANSIT CORP.

690 GULF REFINING CO.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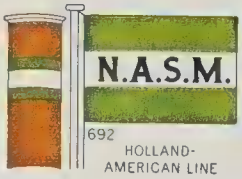
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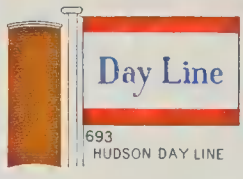
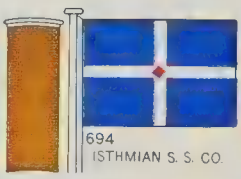
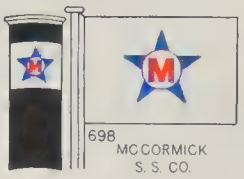

693 HUDSON DAY LINE

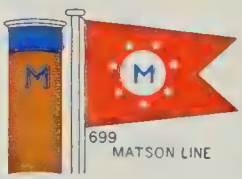

694 ISTHMIAN S. S. CO.

695 ITALIAN LINE

696 LUCKENBACH LINE

697 LYKES BROS. S. S. CO.


698 MCCORMICK S. S. CO.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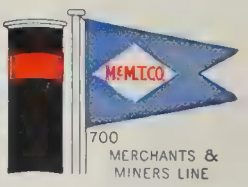
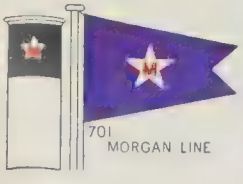
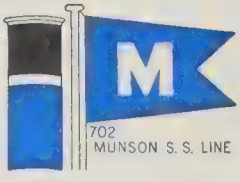
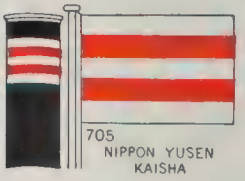

700 MERCHANTS & MINERS LINE


701 MORGAN LINE


702 MUNSON S. S. LINE

703 MYSTIC S. S. CO.

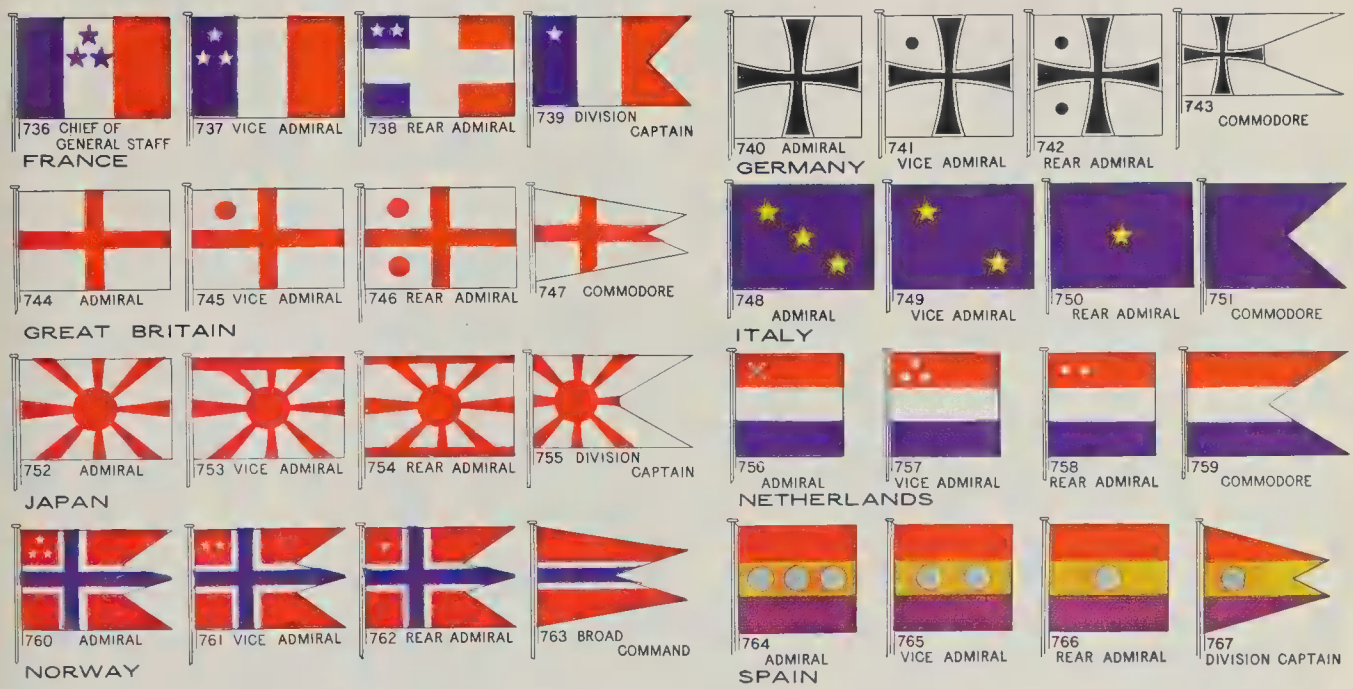
704 NEW YORK & PORTO RICO S. S. CO.


705 NIPPON YUSEN KAISHA

FUNNELS AND FLAGS OF UNITED STATES AND WORLD STEAMSHIP COMPANIES

706 NORTH GERMAN LLOYD
707 NORTON LINE
708 NORWEGIAN-AMERICAN LINE
709 OCEAN DOMINION S. S. CORP.
710 OCEANIC & ORIENTAL NAV. CO.
711 OCEANIC S. S. CO.
712 OLD BAY LINE
713 OSAKA SHOSEN KAISHA LINE
714 PACIFIC STEAM NAV. CO.
715 PANAMA PACIFIC LINE
716 PANAMA R.R. S. S. LINE
717 PENINSULAR & OCCIDENTAL LINE
718 PENINSULAR & ORIENTAL S.N. CO.
719 RED D LINE
720 RED STAR LINE
721 ROYAL MAIL S. P. CO.
722 SCANDINAVIAN-AMERICAN LINE
723 SOUTHERN STATES LINE
724 STANDARD FRUIT & S. S. CO.
725 STANDARD SHIPPING CO.
726 STATES S. S. CO.
727 SWAYNE & HOYT LINES
728 SWEDISH AMERICAN LINE
729 TEXAS CO.
730 UNION CASTLE MAIL S. S. CO
731 UNION S. S. CO. OF NEW ZEALAND
732 UNITED FRUIT CO.
733 UNITED STATES LINES
734 WARD LINE
735 WHITE STAR LINE

FUNNELS AND FLAGS OF UNITED STATES AND WORLD STEAMSHIP COMPANIES



FLAGS OF RANK IN WORLD'S MAJOR NAVIES

This flag is reputed to have been the flag of the old Central American Union, which broke up in 1839. The five mountains on the coat of arms of Salvador are retained in remembrance of the old Union with its five States.

506. San Marino.—The colors on the flag of this small Republic on the Adriatic are white and blue. The arms consist of a blue shield upon which stand three green hills, each surmounted by a white tower with an ostrich feather floating from its battlements. This shield is supported by a wreath of oak and laurel and bears a crown.

507. Siam—Ensign.—Siam gets the white elephant which figures on so many of its flags from the legend that before Zacca, the founder of the Nation, was born, his mother dreamed that she had brought forth a white elephant. Siamese wise men declare that after 80,000 changes, Zacca finally ended his experience as a white elephant, and thence was received into the company of the gods.

508. Spain — Ensign and National. — When the monarchy was overthrown in 1931, the new Republic retained the old red and yellow, but added purple. The arms of the Republic, which are reproduced on the Ensign and National Flag, but are omitted from the Merchant Flag, contain a yellow triple-towered castle on a red field for Castile; a red lion rampant on a white field for León; four vertical red stripes on a yellow ground for Aragón; yellow chains on a red ground for Navarre; and a pomegranate on a white ground for Granada.

509. Sweden—Ensign.—The Swedish flag, a yellow cross on a pale-blue field, has been flown since Gustavus Vasa became the King of Sweden in 1523. The National Flag is rectangular, as is also the Merchant Flag, while the Ensign has swallow tails and a tongue.

510. Switzerland.—The white cross on a red field, which constitutes the National Flag of Switzerland, dates from the Crusades. After an enumeration of the Swiss forces leaving Bern to march against the coalition of nobles in 1339, they were said to have been "distinguished by the sign of the Holy Cross, a white cross on a red shield, for the reason that the freeing of the Nation was for them a cause as sacred as the deliverance of the Holy Places!"

511. Tibet.—With its towering mountain of snow, before which stand two lions fighting for a flaming gem, the flag of Tibet is one of the most distinctive of the East.

512. Turkey.—A legend states that when Philip of Macedon besieged Byzantium in 339 B. C. and endeavored to undermine the walls after all other forms of attack had failed, the light of a crescent moon revealed the presence of his warriors to the Byzantines. The crescent on the Turkish flag is a memorial to that revelation.

513. U. S. S. R.—Ensign.—The Ensign of the Soviet Union is red, with the white sun having eight narrow rays. Upon the sun is imposed a red star having in its center the crossed sickle and hammer which are the emblem of the working man's Republic.

514. U. S. S. R.—National and Merchant. The National and Merchant Flag of the Soviet Union has the crossed sickle and hammer emblem of the State in the canton, with a 5-pointed yellow-outlined star above them.

515. Uruguay.—One flag serves Uruguay alike for its Merchant Marine, its Navy, and as its National Emblem. Where ours has 13 stripes of red and white, Uruguay's flag has nine of white and azure. Where our flag has a canton of blue, Uruguay's possesses one of white. The stars of ours become a sun in the Uruguayan banner.

516. Venezuela—Ensign.—The Venezuela flag is a tricolor of yellow, blue, and red, with the arms of the country in the corner next to the top of the staff. Many arrangements have been developed for the seven stars on the middle section. The latest one is a half-moon effect. The seven white stars denote the seven provinces of Caracas, Cumaná, Barinas, Margarita, Barcelona, Mérida, and Trujillo, which formed the Venezuelan Confederation of 1811.

517. Yugoslavia. — The Ensign of Yugoslavia, with its double-headed eagle, dates from 1918. On the breast of the eagle are the arms of Serbia, Croatia, and Slavonia. The National and Merchant Flags are the same as the Ensign, except that the arms are omitted.

YACHT AND INTERNATIONAL CODE FLAGS, MARINE SIGNALS, ETC.

518. Yacht Ensign. — In 1848, Congress, enacting a law governing the licensing of yachts, provided that all those so licensed should wear a flag of the form, size, and colors prescribed by the Secretary of the Navy. The Government reserved the right of its architects to copy such yachts.

519-524. Yacht Flags.—These flags when flown on a yacht proclaim that the owner is at dinner, that he has guests on board, that the crew is eating, that an ambulance is needed, etc.

525-550. International Alphabet Flags. —These are the flags used to spell out messages.

551-564. Code Pennants for Numbers, etc.—These pennants are used in making numbers and repetitions of numbers, and in denoting that code is to be used or answered.

565-606.—In these combinations of code letters, each tells its own story. When R and Y are shown together, they proclaim that the crew have mutinied; I X advises of serious damage sustained in a collision, etc. Ships using the International Code carry code books which tell at a glance the meaning of each combination of letters.

Official Photograph, U. S. Army Air Corps

WING TO WING, THE 17TH PURSUIT SQUADRON ROARS ACROSS THE SKY

Those gallant knights who man our Army and Navy air fleets pick appropriate and sometimes humorous mottoes and designs for their unofficial squadron insignia. Arctic snow owls diving for prey grace the fuselages of these Army Air Corps ships. Other squadrons sport such emblems as "high hats," Crazy Cats, and bombs riding torpedoes.

607-610. U. S. Buoys and Spars.—These buoys and spars indicate the boundaries of channels and obstructions in them. The red buoys and spars always define the channel on the starboard side of a ship headed into a port. They wear the even numbers, and the black ones, marking the opposite side of the channel, wear the odd numbers. "Red right, returning," is an alliteration which helps the new sailor avoid confusion in these matters.

611-614. Using Wigwag Flags.—Here we have a sailor, a marine, a soldier, and a Boy Scout demonstrating how wigwag messages are sent. The sailor (611) has his flag ready to begin a message or a word. The marine (612) is showing how dots are made. The soldier (613) is in the act of making a dash, and the Boy Scout (614) is saying that he has finished a word or ended a message.

615. Masthead Light Required on Steam Trawlers.—The international rules of the road require that the lights shown here shall be carried at the masthead of every steam trawler and that they shall cover the range indicated.

616-619. Day and Night Pilot Signals.—The Jack at the fore, the International Code letters P T, or the code letter G are day signals, while minute flashes or a blue light showing every 15 minutes call a pilot at night.

620. This chart shows the areas covered by running and other lights on shipboard at night.

621-623. Distress Signals.—An inverted ensign or the letters N C tell of a ship's distress by day, while gunfire at intervals of one minute, flames, rockets, or bombs proclaim distress by night.

624. Life-saving Boat.—Full many a tragedy on rock-bound coasts and sand-barred shores has been averted by the timely launching of the surfboats of sturdy and heroic life savers.

625-629. Life-saving Signals.—This group of signals is used by our Coast Guard in directing rescues by day and night.

630-636. Storm Warnings. — These flags and combinations are used to advise the mariner what the weather may have in store for him.

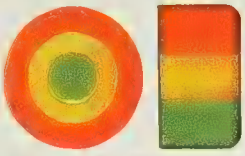
637-641.—These are the old weather-forecast flags, now practically out of use because of the rise of radio, though once they were familiar to everybody.

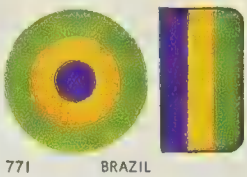
WORLD FLAGS AT THE BEGINNING OF THE 18TH CENTURY

642. Venice.—The winged lion of St. Mark was placed on this flag in honor of the patron saint of Venice. It was St. Mark who, while

768 ARGENTINA

769 BELGIUM

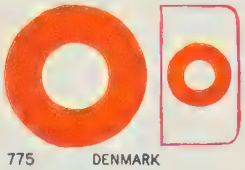

770 BOLIVIA


771 BRAZIL

772 CHILE

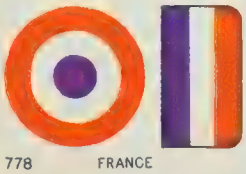
773 CHINA

774 CZECHOSLOVAKIA


775 DENMARK

776 ESTONIA

777 FINLAND


778 FRANCE

779 GREAT BRITAIN

780 GREECE

781 ITALY

782 JAPAN

783 LATVIA

784 LITHUANIA

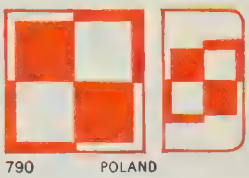
785 MEXICO

786 NETHERLANDS

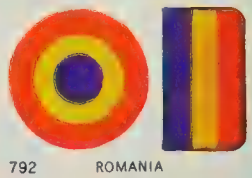
787 NORWAY

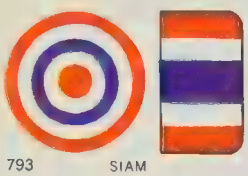
788 PARAGUAY

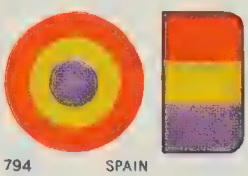
789 PERSIA


790 POLAND

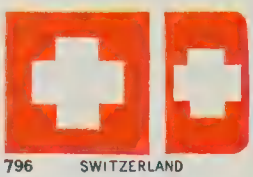
791 PORTUGAL


792 ROMANIA

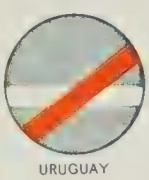

793 SIAM

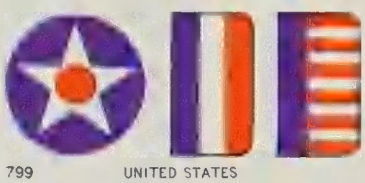

794 SPAIN

795 SWEDEN


796 SWITZERLAND

797 TURKEY

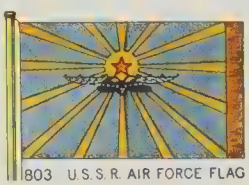

798 URUGUAY

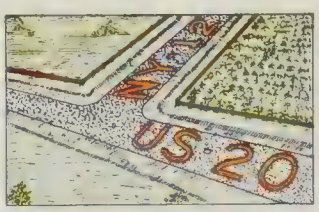

799 UNITED STATES

800 U.S.S.R. (SOVIET RUSSIA)

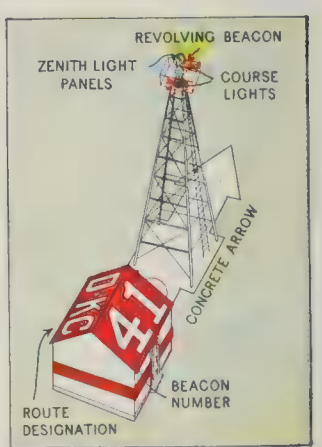
801 YUGOSLAVIA

802 BRITISH AIR FORCE FLAG


803 U.S.S.R. AIR FORCE FLAG



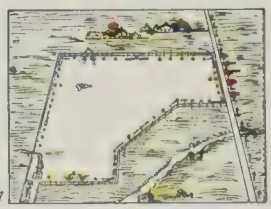
804 HIGHWAY AIR MARKINGS



808 TYPICAL AIRWAY BEACON

805 BRITISH CIVIL AIR ENSIGN

806 GERMAN CIVILIAN PLANE MARKINGS


807 U.S. INTERMEDIATE LANDING FIELD

AIRCRAFT INSIGNIA OF THE WORLD'S LEADING AIR FORCES

stranded on the then uninhabited Rialto, saw in a vision the future greatness of Venice.

643. FRENCH GALLEY.—The fleur-de-lis always has been a favorite device with the French. Early flags show a varied number of them, but flags designed after the accession of Charles VI in 1380 usually contain just three.

644. SAVOY.—The flag of the House of Savoy has played an important rôle in European history. In 1315 it was presented by the Knights of Rhodes to Amadeus the Great when he forced Mohammed II, Emperor of the Turks, to raise his siege before the city of Rhodes.

645. HAMBURGH. 646. LÜBECK. 647. BREMEN. 648. LUNENBURGH.—These four flags belonged to cities which took an active part in the Hanseatic League, the famous federation of North German towns which controlled the commerce of northern Europe during the Middle Ages. Lübeck was the chief city of the League. The colors of these flags, red and white, still survive in the modern flag of Germany.

649. OSTEND ENSIGN.—Ostend was the last stronghold of the Dutch in the South Netherlands against the Spaniards.

650. JERUSALEM.—At the beginning of the 18th century, the flag of Jerusalem showed very little change from the picture of it given by a Franciscan monk in 1350.

651. Moco, ARABA.—The flag of Moco, Araba (Mocha, Arabia) was of great importance two centuries ago, for at that time Mocha was one of the greatest coffee ports in the world.

652. CZAR OF MOSCOVY.—Tradition says that the Czar of Moscovy (or Muscovy), Peter the Great, adopted the design of the Netherlands Flag, merely reversing the colors. The Russians were not flattered by this, for it made them appear "Dutchmen in distress" (the sign of distress being an inverted flag). Peter added the blue cross to distinguish his flag from the Dutch distress signal.

653. BENGAL GRAND MOGUL.—The group of Bengal villages which grew into the city of Calcutta was under this flag at the time that the East India Company purchased them from the great-grandson of Shah Jahan (builder of the Taj Mahal).

654. AMOY, CHINA.—One of the peculiar characteristics of many Chinese banners is the broad, deeply notched border, differing in color from the field of the flag.

655. RED DRAGON OF WALES.—Uther Pendragon, father of King Arthur, had a vision of a dragon in the sky. When the prophecies of the seers, who interpreted this as meaning that he would ascend the throne, were borne out, Uther carried a gold dragon with him into battle. Under the reign of Edward VII it was incorporated into the armorial bearings of the Prince of Wales.

STEAMSHIP FUNNELS AND FLAGS

656-735.—From the early days of ocean-borne commerce, shipping lines have flown their own house flags as the readiest possible means of quick identification of their craft. With the advent of steam, the funnels offered a new means of identification, and in these 20th-century times have come to possess a romantic lore of their own.

Could some of these funnels and flags speak, what stories of adventure they could tell—of storms they have ridden out; of billowy seas they have braved; of lives they have rescued; of passengers they have carried; and cargo they have handled.

Western prince and Eastern potentate; financial wizard and industrial magnate; tourist seeking the relaxations of the sea and the pleasures beyond; immigrant fleeing the hard lines of an overcrowded homeland and bound for other shores where the star of hope leads him—yes, in the lives of those who go down to the sea in ships these flags and funnels epitomize the romance of the world.

FLAGS OF RANK IN MAJOR NAVIES

736-767.—Officers above the rank of Captain in all navies have their own flags of command. In the French, Japanese, Norwegian, and Spanish Navies, the grade of Commodore does not exist. Ranking Captains are given command of divisions of the fleet and in that command fly the flag that corresponds to those flown by Commodores in other navies. In our own Navy the rank of Commodore has been abolished, except for a few officers who have been retired. As soon as they pass, the Commodore's flag will cease to exist.

INTERNATIONAL AIRCRAFT MARKINGS

Many nations have adopted military and naval aircraft markings. In most cases these markings follow the colors of the flag of the country represented by the plane. In a few cases, as in Great Britain and Soviet Russia, special Air Force flags have also been designed. In some cases, such as Germany and Bulgaria, no military or naval planes may be owned or built; so their planes are limited to civilian markings.

768. Argentina uses an anchor on the Army circle to indicate that a plane is in the naval service. The military service omits the anchor.

769. Belgium is fast replacing its old and obsolescent planes with new British and American craft of latest design.

770. Bolivia has a fleet of American planes which it uses both for war and transportation.

771. Brazil is developing her ground facilities with funds raised through a special stamp required to be placed on all letters mailed through the Postal System.

772. Chile has 9 commercial and 7 military airports and 11 landing fields.

773. China's helplessness before the Japanese attack on Shanghai has made her people air-minded. Large orders have been filled, including one for 50 pursuit planes capable of 200 miles per hour.

774. Czechoslovakia has a membership of 70,000 in its aëronautical organizations, out of a total population of 15,000,000.

775. Denmark has about 90 military and naval airplanes. The rudder insignia varies between the planes of the two services.

776. The Estonian Air Service has a fleet of 30 British-built planes.

777. Finland's air fleet consists of about 100 land and sea planes.

778. France in 1933 had a total of 164 air squadrons, made up of 1,850 active planes. Air France, the consolidated commercial air interests, has schedules that call for 5,538,000 plane miles of flying annually.

779. Great Britain has more than 2,000 planes. Her aim is to develop a fighting plane with a speed of 300 miles an hour when loaded with full military equipment.

780. Greece distinguishes between her military and naval planes by the use of sky-blue markings for the former and dark-blue ones for the latter.

781. The Royal Italian Air Force has more than 2,000 combat planes. The new airport at Milan, 7,800 by 5,800 feet, will be the largest in Europe.

782. Japan is developing its own aircraft industry and plans to build all its own equipment. Individuals and organizations have presented the Government with more than 100 planes.

783. Latvia has a fleet of about 60 planes in its military forces.

784. Lithuania wears its white double cross on about 75 military planes.

785. Mexico has established its own military factory and in 1933 produced 31 planes powered with American engines.

786. In addition to having an excellent fleet of military planes, the Netherlands has the longest air route in the world, connecting the Netherlands with Netherland India—some 9,000 miles.

787. Norway's air defenses possess about 40 naval aircraft, 75 military planes, and 40 training and other planes.

788. Paraguay's war in the Gran Chaco has resulted in the development of a new military air service.

789. Persia in 1933 bought from British manufacturers 30 fighting planes and 10 training planes. She also bought 40 engines and metal propellers in the United States.

790. Poland has an air fleet of 1,000 modern planes and a military air force manned by 9,000 officers and men and 1,300 pilots.

791. Portugal's air force consists of 90 military and 24 naval planes.

792. Romania has about 150 military planes in active service.

793. Siam has turned over to the Siamese Aërial Transport Service those activities developed by the military air force since 1922. The Government is developing its own factory for supplying its military needs.

794. Spain is planning the development of a Spanish air armada and has established a general aëronautical school.

795. The Royal Air Force of Sweden had 200 planes in 1933.

796. Switzerland's air strength lies in its commercial fleet. The Swissair Company operates what is admittedly the fastest commercial air service in Europe.

797. The Turkish Government has established a national airplane factory at Kayseri and has started the building of its own aircraft under the supervision of Curtiss-Wright personnel.

798. Uruguay found itself lacking in funds to carry forward the work on a naval and commercial airport at Montevideo in 1933.

799. Numerically, the United States ranks fourth in air strength. In its Army and Navy air services it had, in 1933, approximately 1,700 combat planes universally admitted to be second to none, ship for ship.

800. Soviet Russia has approximately 2,200 combat planes, but of these 1,200 are of such obsolescent types in construction and performance that most of them are disregarded in any estimate of the relative air strength of the leading nations.

801. Yugoslavia has about 700 military airplanes and a like number of pilots.

802 and 805. The British Royal Air Force flag and the British Civil Air Ensign tell how deep is the interest of the British Empire in aviation.

803. Soviet Russia's Air Force flag is a modification of the National Ensign, with the figure of an airship imposed thereon.

804. This drawing shows how National and State highways are marked in America.

806. Germany, not being allowed military planes, places the Swastika and red stripes on the two sides of the rudders of her planes.

807. This drawing illustrates the type of intermediate landing fields in use all over the United States.

808. This typical airway beacon, with its tower lights, route designations, and beacon numbers, shows how the pilot is guided along the air lanes as he flies.

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THE NATIONAL GEOGRAPHIC MAGAZINE

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EXPLORING THE STRATOSPHERE

By Captain Albert W. Stevens

Scientific Observer of the National Geographic Society-U. S. Army Air Corps Stratosphere Expedition

TO LOOK back, we were indeed in a strange predicament.

We were imprisoned in a stout metal shell, hanging from a huge balloon, more than eleven miles above the earth. Yet we had at arm's length two hatches we had only to open to be free.

One of the hatches had a lever to facilitate prying it open. But no one made a move toward the lever. To have opened it would have meant almost instant unconsciousness from change of pressure. Our tissues would have expanded suddenly, somewhat as would those of certain fish drawn hurriedly to the surface from ocean depths, and the results would have been both distressing and disastrous.

A PLEASANT COMPARTMENT—11 MILES ALOFT!

Our lofty prison was a very livable place. We were perfectly familiar with every square inch of it, for we had been in and out of it dozens of times daily for many weeks. It was airtight; it resisted all the strains of the heavy load it carried; it was almost comfortable, certainly much more so than we had expected.

The inside walls were painted a glossy white, and on them shone bright rays of sunlight streaming through the glass ports above our heads. All around us were scientific instruments, and their subdued clatter, ever increasing as the balloon ascended, had been music to our ears.

With earphones on our helmets and microphones in front of us, we could talk, allowing a few minutes for necessary connections, to practically anyone in the United States. We were neither hungry nor thirsty, and the artificially prepared air we breathed was surprisingly good.

Suddenly and without warning there came a great rent in our balloon! A glance above us just a few minutes before and all had been well; soon we were dropping—bag, gondola, instruments, and men.

So long as things held together reasonably well, there was hope. But if too many breaks in the fabric developed the gondola would go hurtling through space, and we with it.

With a free fall of nearly 11½ miles, starting in air approaching the thinness of a vacuum, the downward speed would be so great that we could scarcely expect to push through the rush of air across the hatch openings, even should we be able to open hatches at precisely the right time.

Later it became necessary for one of us to dive through a hatch when our gondola was falling more than a mile a minute. But such a dive could not have been made had the rate of free fall been five miles a minute.

* * * * *

Let us start with our ascent on the National Geographic Society-U. S. Army Air Corps Stratosphere Expedition. The take-off was shortly after sunrise (5:45 mountain standard time), July 28, from the Black Hills of South Dakota. Here, for many weeks, at the Stratosphere Flight Camp near Rapid City, scientists, Army officers, veteran balloonists, troops, and many civilian workers had toiled day and night in

Photograph by Richard H. Stewart

THE CREW OF THE "EXPLORER"

Major William E. Kepner, pilot, stands between Capt. Albert W. Stevens, scientific observer (right), and Capt. Orvil A. Anderson (left). Behind them is the gondola, built by the Dow Chemical Co., in which they were sealed while in the stratosphere. The upper half is white in order to reflect away some of the heat of the sun's rays and so prevent an uncomfortably high temperature inside during the middle of the day. The lower half is black to absorb heat rays from the earth.

preparation for a flight by means of the largest free balloon ever constructed.

From the inception of the project, in the fall of 1933, with the guidance of the scientific committee appointed by President Grosvenor, no pains were spared to produce the best possible instruments and equipment for collecting scientific data in the stratosphere. The instruments were to be of full laboratory size to insure the greatest attainable accuracy. This meant that some would be both bulky and heavy.

THE LARGEST FREE BALLOON OF ALL TIME

To house these many large instruments, it became necessary to design a gondola larger than any that had previously been sent aloft.

Finally, it became apparent that to lift the gondola and its cargo of apparatus high into the stratosphere, a very large balloon would be required. Experts were consulted, skilled in such construction, and a contract was given to design and build a larger balloon than any previously constructed—a bag which, when fully inflated, would contain three million cubic feet of gas.

It required five months to fashion this gigantic bag, and into it went two and a third acres of rubber-impregnated cloth made from long-staple cotton. While it was being built, work was begun on the gondola, a globe of dowmetal, lighter than aluminum; and in a score of laboratories and workshops from New York to California specially designed instruments were being constructed.

Meanwhile a site for the base camp of the stratosphere flight had been chosen in western South Dakota. Three considerations determined this choice: the point was far enough west to permit the balloon to drift even 700 or 800 miles to the eastward and still come to earth in relatively level, unforested country; the record of the region was promising for good summer flying weather; and the site was sheltered from surface winds.

Early in June a camp was established in the deep, cliff-encircled natural "bowl" twelve miles southwest of Rapid City. It quickly became known as the "Stratocamp."

Photograph by Lieutenant James F. Phillips and Master Sergeant G. B. Gilbert

THE BALLOON MAKES A WAYSIDE STOP

So that certain instruments might be lowered, others set going, and the hatches closed, the flyers "leveled off" their huge craft at an altitude of 15,000 feet. The outside spectrograph is shown partly lowered. In the rigging above the gondola are a United States flag and the flag of the National Geographic Society. The outskirts of Rapid City, South Dakota, headquarters for many of the arrangements for the flight, appear in the distance to the right (see text, page 434).

Photograph by Edwin L. Wisherd

WORKERS WORE SHOES OF CLOTH WHILE PUTTING THE BALLOON TOGETHER

In every way the fabric was protected while the huge gas bag took shape. All windows in the factory room were sealed, and only filtered air was admitted. The discarded shoes of a worker are shown in the foreground. Not a stitch was taken in putting together the two and a third acres of rubberized cloth that was used. Every seam was cemented and then reinforced by tape on both sides. The seams of the finished balloon were even stronger than the adjoining fabric.

Captain Orvil A. Anderson was on the scene from the start. Under his capable direction the camp developed from an almost deserted basin into a bustling little village of more than a hundred inhabitants (see illustration, page 405).

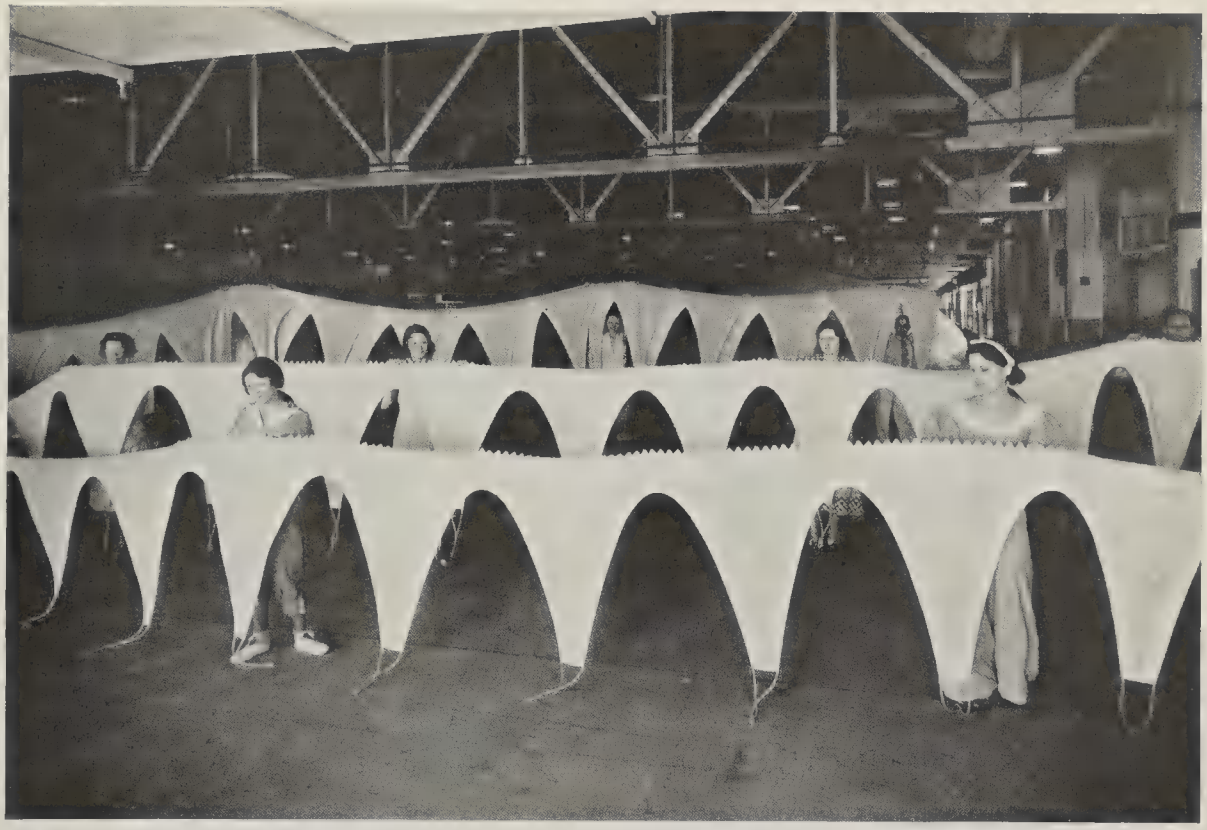
Within a few weeks it had its drainage system and sawdust-paved streets, a waterworks, two electric lighting systems, a sewage disposal plant, parking spaces, traffic officers, a hospital and ambulance. There was even a fire department with a full-size hose wagon, two professional fire fighters, a dozen fire extinguishers, and a volunteer corps to operate them, providing a safeguard against accident in handling quantities of explosive gas. No smoking was permitted in the neighborhood of the hydrogen cylinders.

Three telephone lines and two radio stations kept the Stratocamp in communication with the outside world; and there were two telegraph wires leading to teletype machines which constantly rapped out weather information from points as far away as Alaska, Cuba, and Iceland. The special weather station set up at the camp, through the coöperation of the U. S. Weather Bureau, the Signal Corps, and the Air Corps, ranked, in fullness of information furnished, with the half dozen most important weather stations in the United States (see illustration, page 418).

Two weeks after the camp was started I went out by plane from Washington, taking some special instruments. A few days later Major William E. Kepner flew into Rapid City, and our flight personnel was complete.

Freight-car loads and truck loads of the equipment necessary for a stratosphere flight had been converging on the Stratocamp for weeks. Three railroad cars filled with heavy steel cylinders containing compressed hydrogen arrived in Rapid City. Thanks to the generous coöperation of the National Guardsmen of South Dakota and their fleet of trucks, these tons of steel were soon neatly piled along one edge of the camp (see illustration, page 406).

The gondola rolled in by truck, after a journey of more than a thousand miles,



Photograph by Edwin L. Wisherd

THESE SCIENTIFICALLY DESIGNED SCALLOPS OF CLOTH SAFELY SUPPORTED A FOUR-AND-A-HALF-TON LOAD

From the loops at the ends of the 160 tabs of this "lower catenary band" extended the ropes which sustained the gondola with its cargo of men and instruments. This vital feature of the equipment showed no breakage or strain, but held fast to the fabric above and the ropes below even after the top portion of the balloon exploded. A small rope is hemmed into the curved edges of the scallops, which are in the form of the mathematical curve known as a catenary. This shape serves to distribute the downward pull evenly to the fabric above.

from Midland, Michigan, and was installed in the commodious gondola house, the entire front of which could be opened up. This became our workshop.

A few days later another truck brought in a huge box containing the balloon bag, which weighed two and a half tons, carefully packed in a waterproof container. The box was placed on blocks in the exact center of the level floor of the "bowl," protected from sun and rain by a canvas tent fly, there to remain until the day of the inflation.

INSTRUMENTS ARRIVE BY AIRPLANE

The largest truck of all to traverse the winding road down into the basin arrived the following week—the liquid-oxygen generator truck of the Army Air Corps. It supplied the essential liquid oxygen used to make breathable air inside the gondola during our stay in the stratosphere.

Several airplane loads of instruments were flown to Rapid City; and daily freight and express packages arrived, their contents varying from machine-shop tools to delicate vacuum tubes.

For many weeks the gondola house was the center of activities that started sometimes as early as 4 o'clock in the morning and often lasted until 9 at night. Our numerous instruments and pieces of equipment had to be assembled, tested, some of them altered, and all of them firmly fixed in the places assigned to them on the gondola shelves or hanging from the gondola roof.

The last of this preparatory work was completed on July 9. From that time on we could have flown any day, so far as the equipment was concerned. But it was essential that we make our flight during very special—and, unfortunately, rare—weather conditions covering the area for seven or eight hundred miles east.

Photography was to play an important part in our work during the proposed twelve hours aloft; and for satisfactory photog-

raphy we must have cloudless skies and good visibility. Only a broad area of high atmospheric pressure could assure such conditions, and we determined to wait for such a "high" if it took all summer!

None of us was willing to mark time lazily. We opened up the gondola house as usual every morning and busied ourselves in making tests and in figuring out minor, and sometimes major, improvements to the instruments.

Dr. Lyman J. Briggs and Dr. W. F. G. Swann collaborated during this waiting period in building a dehumidifying apparatus to "wring" surplus moisture from the air of the gondola. It was a complete success and greatly contributed to our comfort and efficiency while the gondola hatches were closed.

Major Kepner brought his long ballooning experience and meteorological knowledge to bear on our weather problem during the weeks following July 9. At 10 o'clock every morning and at the same hour every evening, the current weather maps were completed by the camp's weather staff, under the direction of Mr. V. E. Jakl, of the U. S. Weather Bureau (see illustrations, pages 413 and 418).

Major Kepner pored over these maps with the weather staff as soon as they were available, searching for favorable indications to the west and northwest, where "highs" might be developing days before they could reach the Stratocamp.

Everyone concerned with the expedition—the scientists, the entire camp personnel, and the newspaper correspondents covering the flight—realized that weather was the final and necessary ingredient in a stratosphere flight; so we watched the twice-daily ritual of map examination with the keenest interest. Day after day the news that came from the weather room was discouraging.

AT LAST THE WEATHER IS "RIGHT"!

At last, on July 27, the long-awaited high-pressure area had drifted in from the west and promised for the next day the conditions which we wanted both at the Stratocamp and to the east. When, at noon, Major Kepner announced officially that the weather was satisfactory for the flight and that the inflation would begin that evening, the camp was galvanized into activity.

Guests were barred from the floor of the "bowl"; only men with definite jobs to perform were permitted in the camp. The balloon box was opened and the huge, billowy mass of fabric was spread out on the circular sawdust-covered, canvas-protected bed that had been prepared for it (p. 405).

Bus load after bus load of soldiers arrived from Fort Meade. They were the men of the ground crew who were to hold the balloon in leash while the hydrogen poured into it.

At the gondola house, those of us concerned with the instruments were extremely busy. A definite schedule was worked out, minutes were allotted, and, one after the other, specialists climbed into the black and white ball to install batteries and to give their instruments a final tuning up.

INFLATING THE GIANT BAG

On all sides the preparations moved ahead like clockwork. At dusk the floodlights in the great ring that extended around the floor of the basin were turned on, and a little later the hydrogen gas was started through the canvas tubes into the vast maw of the balloon (see illustrations, pages 412 and 416).

Before 2 o'clock in the morning the inflation had been completed. Held to the earth only by slender ropes, the huge bag towered overhead, a beautiful sight as its top melted into the dim shadows above the direct rays of the floodlights. The weather was ideal. Hardly a movement could be detected among the acres of cloth.

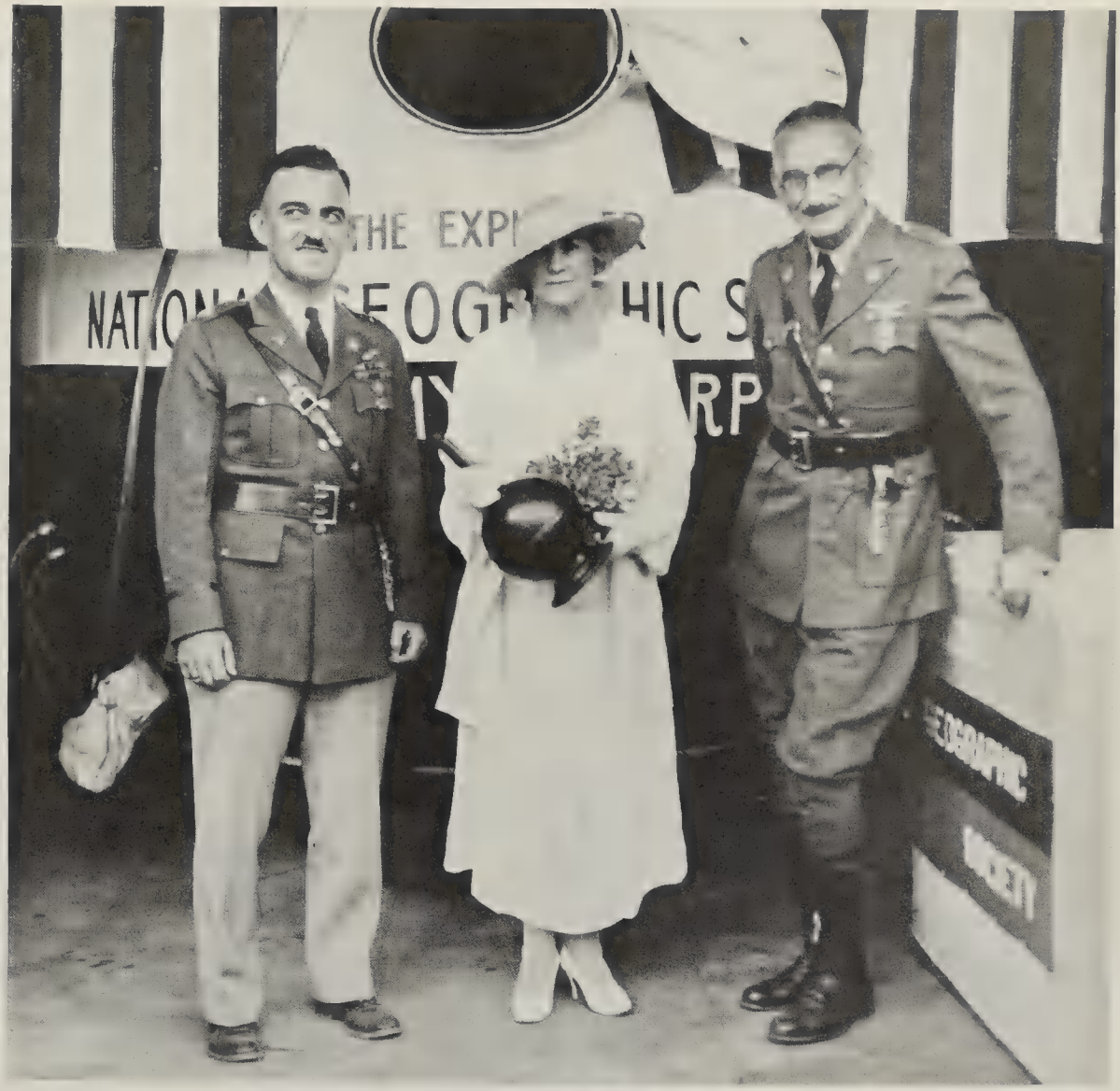
Quickly the gondola, its instruments all in order, was wheeled under the dangling center ropes and the three-hour task of lashing it to the balloon was begun.

By shortly after 5 o'clock there remained only a few last-minute tasks to be performed—the careful placing of rope-ends for valve and rip cords; the lashing on of a small mail sack; the loading of warm flying clothes and parachutes.

Captain Anderson and I climbed into the gondola; Major Kepner to its rope-enclosed top, the better to direct the take-off.

The outer ropes were dropped; only the gondola and ten small hand ropes attached to it held the gigantic bag of gas to the earth (see page 419).

Major Kepner directed the final ground activity of the flight (see page 415) before the ascent—the weighing-off. Ropes were slackened to test the balloon's lift. Ballast was adjusted until the upward pull seemed just right.



Photograph by Acme

THE "EXPLORER" IS CHRISTENED WITH LIQUID AIR

Mrs. Berry, wife of the Governor of South Dakota, holds a double-walled metal flask of the liquid. Major Kepner stands at the left; Captain Stevens at the right.

Then came the order, "Cast off!"—and we were away for the stratosphere!

Below us the ground dropped rapidly away, and the *Explorer* swept over the rim of our camp, in a direction eastward toward Omaha. As we rose higher and higher we could look back on the deep bowl, and we saw that thousands of people had gathered during the night around the rim to watch the take-off (page 408).

But we were rising rapidly—too rapidly, in fact—and could pay no further attention to the ground. It was important to get the balloon under control and all of our equipment functioning properly.

Under the direction of Major Kepner and Captain Anderson, who were outside arranging things in the rigging, I worked the balloon hydrogen gas valve from inside the gondola. At first we valved cautiously, but it soon became evident that we were riding a different kind of balloon from any we had known before. It "took the bit in its teeth," and kept on soaring skyward faster than was desired for recording data. But we kept the valve open for longer and longer intervals, and finally the ascent became slower.

Major Kepner and Captain Anderson had been standing by to handle the external emergency gas valve which was operated by the usual rope. When it became apparent that the pneumatic valve was able to handle the required volume, Captain Anderson joined me inside and established equilibrium at 15,000 feet (see chart, page 431).

THESE MASTERS OF HORSES BECAME MASTERS OF BALLOONS

The ground crew of 120 dismounted troopers of the Fourth United States Cavalry from Fort Meade, South Dakota, had no previous experience with balloons, but quickly mastered the novel job. Their practice with the demonstration balloon of 35,000 cubic-foot capacity helped. Above the flight-camp administration cabin, where they are lined up, floats the National Geographic Society flag.

Photographs by Richard H. Stewart

IN PRIMITIVE GARB, THEY SEE ONE OF THE WONDERS OF SCIENCE

Sioux warriors and their squaws from a reservation on the plains of South Dakota journeyed to the Black Hills to see the gondola of the stratosphere balloon. The brave in the center is going through a few steps of a dance, while other visitors to the flight camp look on.

Photograph by Lieut. James F. Phillips, U. S. Army Air Corps

THE BALLOON'S SAWDUST RING RESEMBLES A GIANT'S GRIDDLECAKE

The sawdust is not a figure of speech: four inches of it were spread within a level circle, 200 feet in diameter, to cushion the huge bag when spread out for inflation. Around the edges of the circle are canvas ground cloths to cover the sawdust and keep the fabric dry and clean. The inner ring of dots was made by iron rods, with eyelet tops, sunk into the ground to serve as anchor points for ropes to hold the bag during inflation. In the right background are tents of officers and civilian scientists.

I crawled outside and from the slippery top of the gondola assisted Major Kepner in lowering the heavy spectrograph to the required 500 feet below the gondola. I wonder whether any of my readers have ever had the problem of lowering 125 pounds of swaying bulk a distance of 500 feet on a quarter-inch rope! It took us more than half an hour to finish the task, for we had to be extremely careful that the heavy and valuable instrument did not get away from us—or take us with it (p. 422).

When everything outside the gondola was shipshape, Major Kepner and I went inside and closed the airtight manholes. We were now sealed in. Before going any higher we tested the gondola for airtightness. This we did by starting the air vaporizing equipment (see text, page 432). The air pressure built up inside and held. We knew then it was safe to start upward toward the stratosphere.

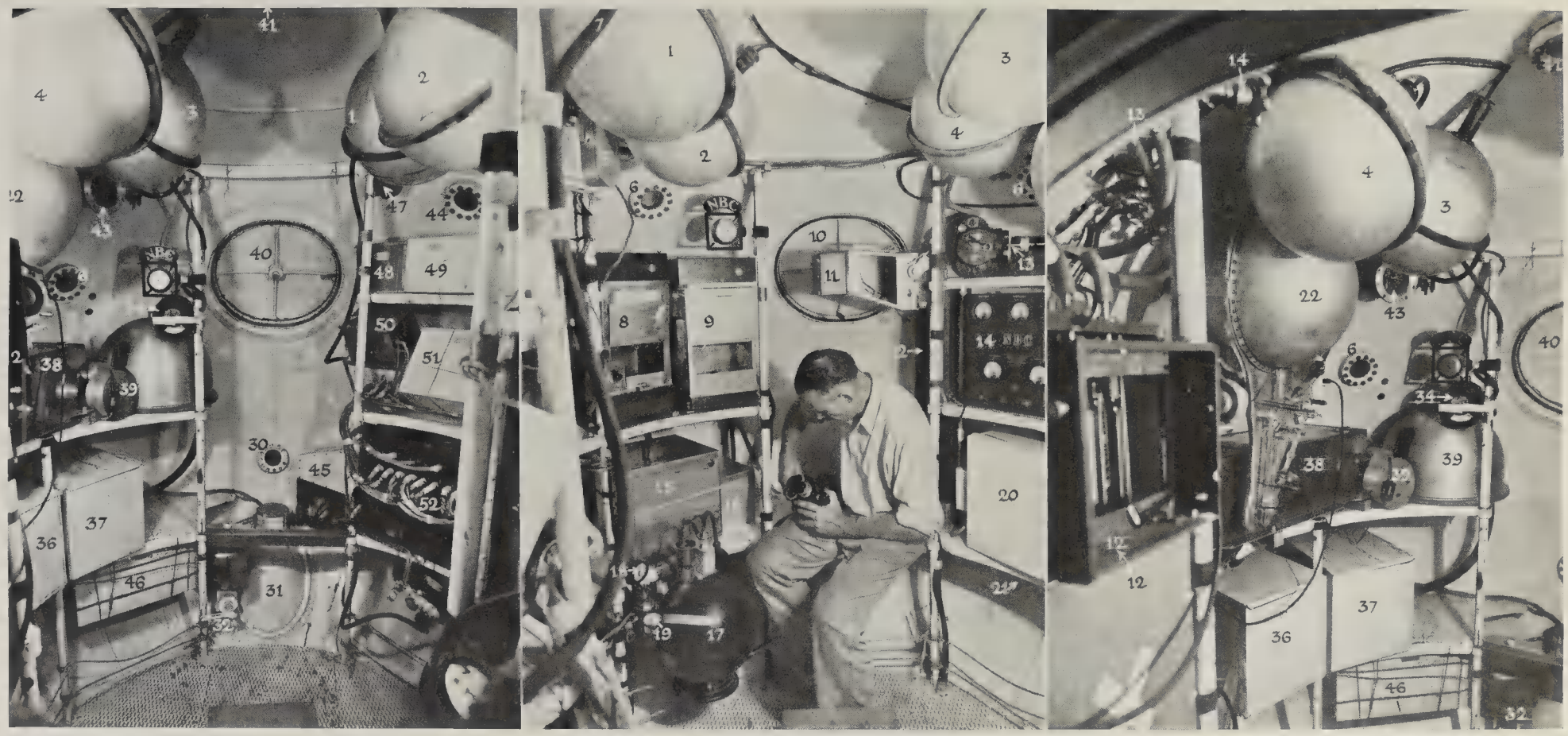
RADIO CONTACT AT 15,000 FEET

While at the 15,000-foot level we made our first contact with the earth by radio. We carried on with ease conversations with General Westover and Dr. La Gorce, Vice

MOTIVE POWER FOR THE FLIGHT: HYDROGEN IN 1,500 STEEL CYLINDERS, EACH WEIGHING 131 POUNDS AND CONTAINING 190 CUBIC FEET

Photographs by Richard H. Stewart

LIKE PILES OF CORDWOOD, THE HYDROGEN CYLINDERS WERE HAULED TO CAMP BY 42 TRUCKS OF THE SOUTH DAKOTA NATIONAL GUARD



THE GONDOLA, FITTED WITH THESE INSTRUMENTS AND MECHANISMS, WAS A LABORATORY OF THE SKIES

Left-hand picture: 1, 2, 3, 4, 22—flasks for obtaining samples of stratosphere air; 41—observation porthole in top of gondola (through this window the tear in the balloon was discovered); 43—altimeter for outside pressure; 47—altimeter for inside pressure; 44, 6, 30—observation portholes (fitted with double pyrex glasses); 34—statoscope (tells whether balloon is rising or falling); 40—manhole assigned to Major Kepner; 48, 49, 50, 51—cosmic ray counters; 12—barometer box; 38—horizon spectrograph (sky spectrograph is behind 22); 39—most heavily shielded electroscope (shell contains 600 pounds of lead); 36, 37, 46—batteries; 45—photographic recording device for cosmic ray counters; 52—switchboard for cosmic ray counters; 31—special vertical observation porthole; 32—air lock for dumping ballast. (It will be noted that some numbers are duplicated for the same instruments in the three pictures.) *Center picture:* 7—balloon valve hose; 5—part of unshielded electroscope; 10—manhole assigned to Captain Stevens; 11—camera for recording barometer readings; 13—Eyemo Motion Picture Camera; 8, 9—Factographs (to take photographs of instrument dials at frequent intervals); 14—National Broadcasting Company's radio transmitter (the receiver is on shelf above, to right); 15, 16, 20—batteries; 18—dial showing pressure in bumper, outside; 19—dial showing pressure in gas cylinder; 17—one of three flasks containing a mixture of liquid oxygen and liquid air; 21—observation porthole. *Right-hand picture:* 13—tubes bringing outside air pressure to barometers; 14—valve to air-sample flask. When the gondola rose, sacks of tiny lead shot ballast were piled around the edge of the floor; the Fairchild camera for vertical pictures was in place in the center of the floor.

Photograph by Lieutenant James F. Phillips and Master Sergeant G. B. Gilbert

THOUSANDS OF SPECTATORS SAW THE "EXPLORER" START SKYWARD

Hundreds of cars are clearly seen parked in a pasture to the right, and other hundreds on the highways. Several thousand more, many of them not easily discerned, are in the woods near the edge of the cliff that rose above the Stratocamp. The balloon (not shown) has just risen. The circular bed from which it took off, whitened by its canvas cover, is seen to the left. Cars brought sight-seers from hundreds of miles. Probably 30,000 people gathered within a radius of a few miles of the camp.

"ARE YOU THERE?" CAME THEIR CLEAR CALL FROM ALOFT

Major Kepner and Captain Stevens are testing the apparatus in the gondola which enabled them to broadcast from far above the clouds, and converse with officers of the National Geographic Society and the United States Army Air Corps in Washington. This mechanism, working perfectly, transmitted one of the most dramatic radio broadcasts ever made, as they told of their thrilling descent to the minute of their escape by parachutes (see page 405).

Photographs by Richard H. Stewart

THE GONDOLA RECEIVES ITS CARGO

An assistant is lifting to a manhole the Fairchild aërial camera which was mounted in a side porthole to photograph toward the horizon. With this camera it was expected that pictures could be made showing laterally the curvature of the earth. Its film roll was ruined when the gondola crashed. To the left, Gustave Fassin, of Rochester, is holding one of the two spectrographs carried inside the gondola.

President of the National Geographic Society, both in Washington, and also requested further weather information from the stratosphere camp.

Our extra-light transmitting and receiving sets, built especially for the flight by engineers of the National Broadcasting Company, functioned perfectly throughout the trip. We made immediate contact with radio stations whenever we found time from our many duties to speak into the microphone (see page 409).

There was something heartening, as we hung far up in the heavens, in being able to talk to those who were following our flight from the earth. Of course there were more practical considerations: our ability to receive weather and other important information in the gondola, and to report our changing positions to the earth. The faultless performance of our communications system—and, in fact, of all our mechanisms—was one of the gratifying features of the flight.

Although we were now in the warm rays of the sun, which should have expanded the gas and provided more lifting power, the *Explorer* was sluggish and seemed disinclined to move upward; in fact, it even settled a little. It became evident that, because we were dealing with an unusually large balloon, the responses were slow. Finally, Anderson discharged bag after bag of ballast through the air-locked hopper—nearly 400 pounds in all. Suddenly the balloon started to rise, and shortly the rate-of-climb meter indicated that we were ascending at 500 feet per minute.

During the next hour the balloon rose steadily to 40,000 feet, which was about what we had planned. On no previous stratosphere flight had a balloon ever been brought to pause on the ascent at points midway between the ground and the maximum altitude of a flight.

Yet, for more than an hour and a half, Captain Anderson, by careful and continuous valving, kept the balloon in practically perfect equilibrium. It neither rose nor fell.

We stayed at 40,000 feet, as scheduled, while the various instruments went through their cycles of operation. We started up the Geiger counter apparatus (see page 407) designed to record the directions of movement of cosmic rays. The magnetic relays of this instrument clicked when a cosmic ray passed through the apparatus in a certain narrow path.

While the clicks had been at the rate of one or two a minute at ground level, already the device was clicking away at a much faster rate. Later on, the relays sounded like many typewriters in a newspaper office, or like a flock of chickens pecking grain from a metal pan. Rays were actually coming in more than fifty times as fast as on the ground (see page 423).

We stopped valving gas and the *Explorer* again started to ascend. It was now nearly noon, mountain time, and for the next hour we moved steadily upward. At 1 o'clock we were approaching the 60,000-foot level, and Major Kepner prepared to bring the balloon again into equilibrium. Valving was begun, and the balloon started to slow down.

ALL IS WELL—THEN A RIP IN THE BAG

At the time, I was giving some instrument readings over the radio. Suddenly a clattering noise was heard on top of the gondola.

We looked upward through the three-inch upper port and saw that the noise had been caused by part of the appendix cord—a small rope—falling on the roof of the gondola.

What had caused the cord to drop? Looking still higher, we were startled to see a large rip in the balloon's lower surface. It was then a few minutes past 1. The gas had not expanded to fill out the balloon completely. Had the rip not occurred, the bottom of the bag should have become spherical at something over 65,000 feet. The hydrogen would have poured out of the 8-foot appendix (an open sleeve of fabric at the bottom of the balloon) and the *Explorer* automatically would have stopped rising. From that point on, as we discharged additional ballast, we could have risen to more than 75,000 feet.

To go higher after the rip appeared was inadvisable. The gas was practically down to the open rip. We valved. But superheat from the sun's rays was expanding the hydrogen so fast that the valve was just able to take care of the excess. It was twenty minutes before the bag started downward. In fact, it rose somewhat.

Imagine our feelings for a few minutes! It looked as though the valve hose had parted along with the torn fabric. Had this happened, we would have been helpless. But the valve did work! We operated that valve altogether no less than 150 times dur-

ing the flight. It never once failed us, though we could neither see it nor hear it working (see illustration, page 421).

Through the overhead glass porthole we watched the rent in the fabric gradually becoming larger and larger. The minutes passed slowly by; the magnets of the cosmic ray instruments clattered on; the buzzers hammered on the barometer box; the instrument cameras clicked in unison at regular intervals.

Above our heads were five glass flasks, each more than a foot in diameter, that had been pumped free from air. We had intended opening these at 75,000 feet to obtain samples of the air of the stratosphere, but now we opened them at 60,000 feet. We heard a faint hiss as each valve was cracked; methodically we shut the valves again, thus sealing the samples.

Across the gondola stood Major Kepner, his hand on the special lever that would release the 80-foot parachute installed by its designer, Major E. L. Hoffman.

Kepner was ready to turn the lever should the balloon suddenly disintegrate. However, when the balloon burst at a much lower altitude, no one was within reach of the lever to release the parachute.

Photograph by Richard H. Stewart

DID YOU EVER SEE A COSMIC RAY'S PORTRAIT?

A study of this mysterious form of energy was a major scientific object of the flight. Here Brig. Gen. Oscar Westover, Assistant Chief of the United States Army Air Corps, is inspecting test photographic records shown him by Captain Stevens. General Westover, a member of the Advisory Committee for the flight and himself a veteran balloonist, flew by plane from Washington to the camp just before the ascent.

DESCRIBING THE DESCENT BY RADIO

Beside Major Kepner was Captain Anderson, with his hand on the control that led to the pneumatic balloon valve. Both officers looked in turn at the bag above, at the rate-of-climb meter (which had now become a rate-of-descent meter), and at the statoscopes, which also gave indication of the speed of descent.

At times we all talked briefly over the radio. But little other talking was done, for our ears were strained to get warning sounds from above us. Soft swishing noises came through the roof of the gondola from time to time. Each of these sounds meant a new rent, or an increase in length of a rip already there.

ABOVE ITS GLEAMING FOOTLIGHTS THE WORLD'S LARGEST BALLOON HOLDS THE STAGE

Throughout the night of July 27-28, more than 60,000 candlepower of electric light flooded the balloon and the ground on which nearly 200 men worked.

Photographs by Richard H. Stewart

THROUGH SNAKELIKE CANVAS TUBES, HYDROGEN SURGED INTO THE HUGE BAG

The photograph was taken on the night of the inflation. Capt. Orvil A. Anderson, in charge of the ground work and copilot during the flight, is shown directing the men who are opening the valves of the cylinders to feed gas into the cloth pipes. The tubes extended 300 feet across the floor of the valley to the opening into the side of the balloon. More than 210,000 cubic feet of hydrogen flowed through the cloth conduits during the six hours of inflation. Over the cylinders is a canopy of pine boughs to protect them from the heat of the sun. The sandbags hold the pipes in place.

There was a temptation to shut off all the switches and quiet the instruments. The sharp drumming of the buzzer hammers on the barometer tubes was particularly irritating. But there was still a possibility of saving the records of the flight; so we let the mechanisms click on.

Below us was the brown, sun-baked earth, so far away that no roads, railroads, or houses could be made out. Our direction of drift was changing, but that was now a matter of little concern. The question now was not *where* we should get down, but *how!*

At the top of our flight an extraordinary phenomenon was visible through the upper porthole. As we looked through the ports that were 45 degrees from the vertical, the sky was the rich dark-blue color associated with high mountain views; but from the vertical port the sky was like black velvet on which ink has been spilled and dried—it was black with just the merest touch of dark blue. It looked as dark as the sky at the time of an eclipse of the sun when stars may be seen.* However, it did not occur to us at the time to look for stars; our interest was in the increasing rents in the great white bag overhead.

Photograph by Richard H. Stewart

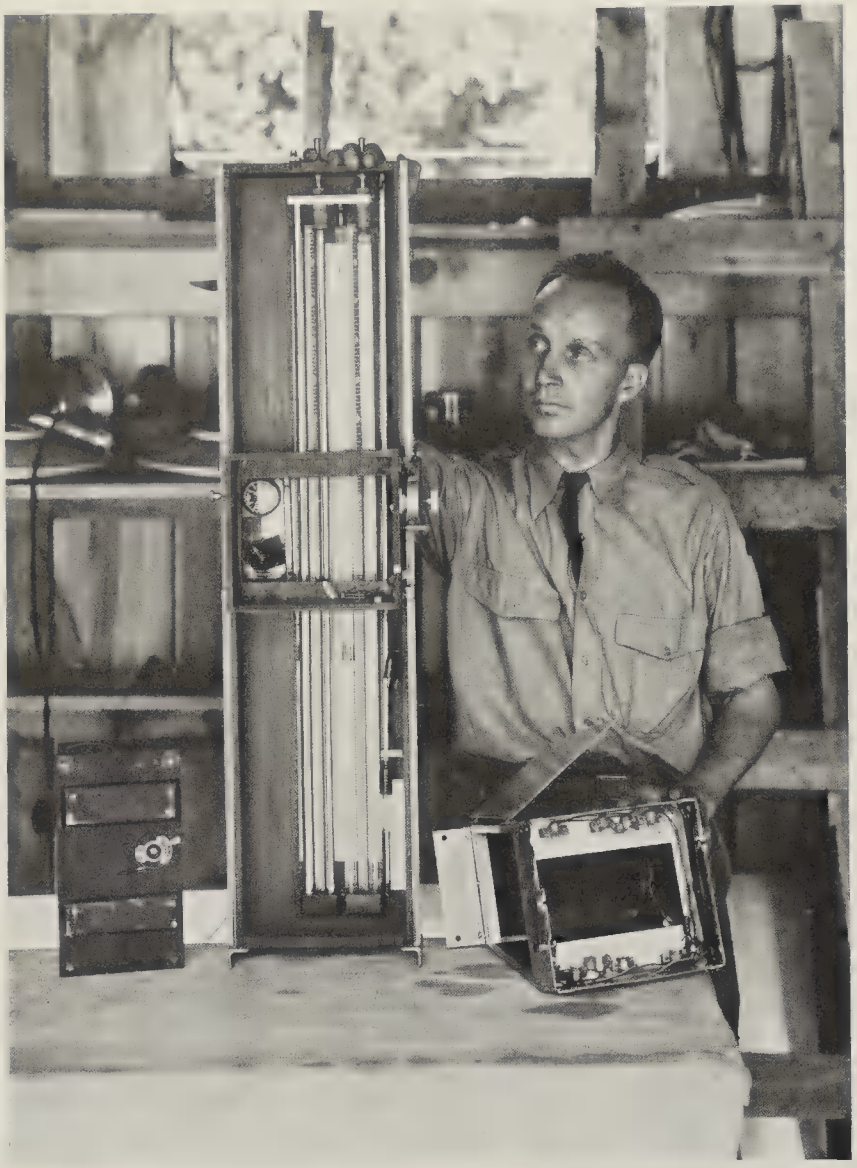
LONG-RANGE SPYING ON THE TOYLIKE PILOT BALLOONS

Tiny balloons were sent up daily from the flight camp to help record the speed and direction of the wind at various altitudes. V. E. Jakl, United States Weather Bureau expert of Kansas City, in charge of the camp's weather station, is sighting a soaring balloon (see illustration, page 418). The small spheres, white, red, or black, depending on whether the sky is clear, leaden, or covered by white clouds, can be seen at surprising distances. On the day of inflation a white one was observed for 57 minutes, until it was more than 30 miles away and 7 miles high.

But we could not fail to note the astounding brilliance of the sunlight and the intensity of the reflected light from the balloon rigging. Some of the ropes, especially those nearest the gondola, were so bright that they had a fluorescent appearance and looked larger than they really were. It is possible that the extreme contrast between the brilliantly lighted balloon envelope and rigging and the sky made the sky look darker than it actually was.

At our high elevation, however, not much light may be expected from the air directly above, because the air of the stratosphere is so clear, so thin, and so free from moisture and dust that it does not scatter the sun's light to the extent that it is scattered nearer the ground.

* See "Ballooning in the Stratosphere," by Auguste Piccard, NATIONAL GEOGRAPHIC MAGAZINE, March, 1933.



Photograph by Richard H. Stewart

TWO BAROMETERS READY FOR A SCIENTIFIC RELAY RACE

Because it was planned to rise through the relatively dense lower atmosphere and to enter a region in which the air is very thin, two barometers were provided. The three white vertical bars on the left (best distinguished at the bottom) are the two glass tubes of a U-shaped mercury column barometer, with a millimeter scale between them. To the right are the similar tubes and scale of a barometer in which the column is a liquid known as n-butyl pthalate. In thin air the mercury column falls very little, even with a considerable increase in altitude. In such regions the n-butyl pthalate column takes up the task and registers more sensitively. On the table to the right is the camera box for recording automatically the readings of the barometers. Beside the barometer box is Lieut. J. F. Phillips, who assisted Captain Stevens in technical work at the flight camp. Lieutenant Phillips, with Master Sergeant G. B. Gilbert, obtained the remarkable photographs of the balloon from the air reproduced with this article.

From our instruments we knew that outside it was almost 80 degrees below zero, Fahrenheit. We were in relatively warm air inside, about ten degrees above freezing, but it was getting steadily colder. Already ice had formed in our gondola in a narrow band about two feet below the top. At first there had been condensation of moisture on the walls. This froze and accumulated still more frost until now there was a layer almost an eighth of an inch thick in places.

Lower down on the walls it was not quite so cold; and, surprisingly, when we lifted the floor panels and felt the metal near the bottom of the gondola, it proved to be relatively warm. Had our flight continued for hours longer, as planned, the temperature inside the gondola would have dropped perhaps to 20 or 30 degrees below zero, Fahrenheit (page 430).

ALTHOUGH FALLING, ROUTINE GOES ON

We still had to go about our routine duties. One was to watch the supply of liquid air, to keep it evaporating at the required rate, and to let air out of the gondola now and then to keep the internal pressure of the sphere to less than nine pounds per square inch.

A little electric fan whirred away, sending its blast of air across the coils of the liquid oxygen apparatus and toward the screens of chemicals that were absorbing the carbon dioxide generated by our breathing (page 421).

Everything inside the gondola was working perfectly, so that it seemed strange to realize we were hurrying downward in the hope of escaping a very real danger.

Three quarters of an hour passed, and we were down to 40,000 feet. Our speed was increasing, and half an hour later we

were down to 20,000 feet. Major Kepner and Captain Anderson each forced open a hatch, and for the first time we felt we were free.

It was good to know that we were in a position to use our parachutes if necessary.

BOTTOM DROPS OUT OF THE BAG

We all climbed out on top and took a good look at the balloon. It was pretty badly torn. Many more tears and rips had appeared in it. The question was, How long would it hold together? As the enormous bag came downward through the air, large waves appeared in the lower fabric, sweeping across it and back again. With almost every wave the rents grew bigger and bigger.

Suddenly the entire bottom of the bag dropped out. We could look up into the whole bare inside of the balloon. Only the part above the lower catenary band now remained (see illustration, page 427). The bottomless bag was acting largely as a parachute. It was a pretty sight, quite round and tight and symmetrical. But it was a bit too tight for safety!

Photograph by Richard H. Stewart

THE GONDOLA RECEIVES ITS LAST-MINUTE GROOMING

Major Kepner is on top of the ball. Captain Stevens appears at the open manhole. Captain Anderson, not shown, is also inside. In front of Major Kepner is the basket containing the spectrograph, which later was lowered to a distance of 500 feet beneath the gondola. In the long dark bundle hanging in the rigging at the left are nine parachutes for use in discarding batteries and other equipment. Below and farther to the left is a bag containing the 80-foot parachute provided to lower the gondola. In a roll below the manhole is the 580-foot drag rope for use in landing. On each side are shown arms supporting instruments. They were later lowered to horizontal positions.

We still had an enormous weight left in the gondola and it was urgent to lessen it. Kepner and Anderson cut loose the spectrograph and it floated down to earth on its individual parachute (see text, page 418).

I climbed back into the gondola and started discharging ballast. In accord with plans decided upon before the flight, all the liquid air that remained was first poured out. Then the two empty containers were fastened to a parachute and thrown overboard. These I followed with hundreds of pounds of lead ballast poured out through the hopper and in streams through the hatch, after opening each sack.

We could have disposed of the ballast much more rapidly if we had hurled it out in bulk, but at no time during the flight was anything thrown out in a way that might injure people on the ground.

Photograph by Richard H. Stewart

A BOUND GIANT TUGS AT ITS BONDS

With all of its gas inside, the balloon was pulling upward with a lift of nearly seven tons. Three of the tethering ropes extending to the upper catenary band, immediately in front of the camera, snapped one after another a few moments before this photograph was taken. Most of the ground crew rushed to the center of the balloon bed and grasped the big bag itself.

We had worn our parachute harnesses constantly during the flight, and when things began to look bad we had each put on the detachable portion, or parachute proper.

We were all set to leave, but we wanted to stay with the balloon as long as possible to avoid being distant from it when we landed.

At 10,000 feet we really should have left the balloon, but we did not wish to abandon the scientific apparatus. So we stayed on. At 6,000 feet we again talked the matter over and decided we had better leave. The last altimeter reading I gave was 5,000 feet above sea level.

Since this part of Nebraska was 2,000 feet above sea level, we were in reality only a little more than a half mile from the ground.

In the meantime Captain Anderson, atop the gondola, had been having difficulty with his parachute. The release handle had caught on something and the parachute

pack had come open. It was a situation that might have been disconcerting to a less cool head. There was only one thing to do—that was to gather the folds of silk under one arm preparatory to leaping.

While getting the fabric together, Anderson stepped down until both his feet were in the hatch from which I planned to leap. Andy is a big man, but never before had I noticed that his feet were large. Now, looking up at the opening partially blocked by his pedal extremities, I shouted:

"Hey, get your big feet out of the way! I want to jump."

Whether Anderson heard me or not does not matter. Things started to happen fast. The feet disappeared, and I knew he had leaped. As he jumped, the balloon exploded.

The pressure suddenly became too great all over, and the fabric burst at once in hundreds of places.

The gondola dropped like a stone.

Twice I tried to push myself through the hatch of the gondola, but wind pressure around the rapidly falling sphere forced me back. So I backed up and plunged headlong at the opening. I managed to hit it fairly, and went out in a horizontal position, face down, with arms and legs outspread like a frog. By that time we had fallen 1,500 feet and were descending so fast that the wind pressure held me practically even with the gondola. In other words, I was not falling away from it, but moving downward at the same rate of speed. I turned over a half revolution and, as I came right side up, pulled my rip cord. The parachute opened instantly.

FALLING FABRIC THREATENS PARACHUTE

The jerk was like that made when one jumps from an airplane at 80 miles an hour. The folds of white silk opened in a large circle—and then a portion of the balloon fabric above the gondola fell on top of my parachute.

For a second it looked as if the balloon would take my chute with it. The fabric covered it to the very center of the silk. And then luckily the parachute slid out from under and worked itself free.

How about Kepner and Anderson? I looked around and saw the other two parachutes in the air and knew they were safe. Directly below me, I heard the gondola hit with a tremendous thud, and saw a huge ring of dust shoot out (p. 429). Forty seconds later I hit—fortunately with a much lighter thud—and the parachute dragged me a few feet on my face through the black dirt of a Nebraska cornfield.

In a very few minutes, Major Kepner, Captain Anderson, and I had rolled up our parachutes and hastened to the spot where the gondola had struck; already a score of people were present, seemingly rising out of the very ground, and in a few minutes hundreds more were coming across the fields to the wreck.

AIRPLANE TRAILS BALLOON'S COURSE

Lieut. J. F. Phillips already had landed his airplane in the adjoining field. He and Sergeant G. B. Gilbert had followed us, making pictures, all the way from South Dakota, had seen practically every detail of our flight up to the altitude they could reach, 25,000 feet, and had actually photographed the final collapse of the balloon as they circled us (see illustration, page 428). We were in a cornfield not far from the town of Holdrege, Nebraska.

It then appeared that hundreds of local people had been trailing the balloon by automobile. Soon the place swarmed with spectators.

The crowd of sight-seers lent willing assistance in rolling up the main section of the balloon fabric into a pile. But, like people the world over, they became relentless souvenir hunters. Numerous small fragments of balloon had fallen like snowflakes all over the farm field, and probably nearly every member of the crowd had picked up a small strip of the rubberized fabric.

Major Kepner and I went to the farmhouse of Mr. Reuben Johnson, on whose field we had landed, to telephone and send some telegrams. For some time I had been conscious that it was nearly 100 degrees in the shade (with no shade), and that I still wore two suits of heavy woolen underwear and a light canvas flying suit; so in the farmhouse I asked permission to use a room to shed some clothing.

In a few minutes I was dressed only in the canvas suit, and I took the two suits of underwear outside and hung them over a fence. Then I went inside to get my messages off by telephone.

When I came out, I found that souvenir hunters had taken my underwear! I have not seen it since. Perhaps by this time it has been cut into small squares.

Photograph by Richard H. Stewart

THESE WEATHER EXPERTS WERE ARBITERS OF THE DATE OF THE FLIGHT

Into this little room in the headquarters cabin at the Stratocamp came by telegraph and radio weather reports fuller than those reaching most of the urban centers of the United States. Complete maps of the North American Continent were drawn morning and evening, so that a careful watch could be kept for approaching weather suitable for the flight. At the right is seated V. E. Jakl, of the U. S. Weather Bureau, in charge of the meteorological work; in the center is Sergeant W. F. Bernheisel, U. S. Signal Corps; at the left stands Private Horace Slutter, U. S. Army Air Corps.

Maybe, like pieces of balloon cloth that have been received by mail, some of it may be sent in with the request that it be autographed!

Things looked pretty black for scientific results when we walked up to the pile of balloon fabric that covered the fallen gondola, pulled it aside, and found that our beautiful black and white globe had been crushed like an eggshell. It had been almost flattened out, and gaping crevices ran in every direction across the irregularly curved top.

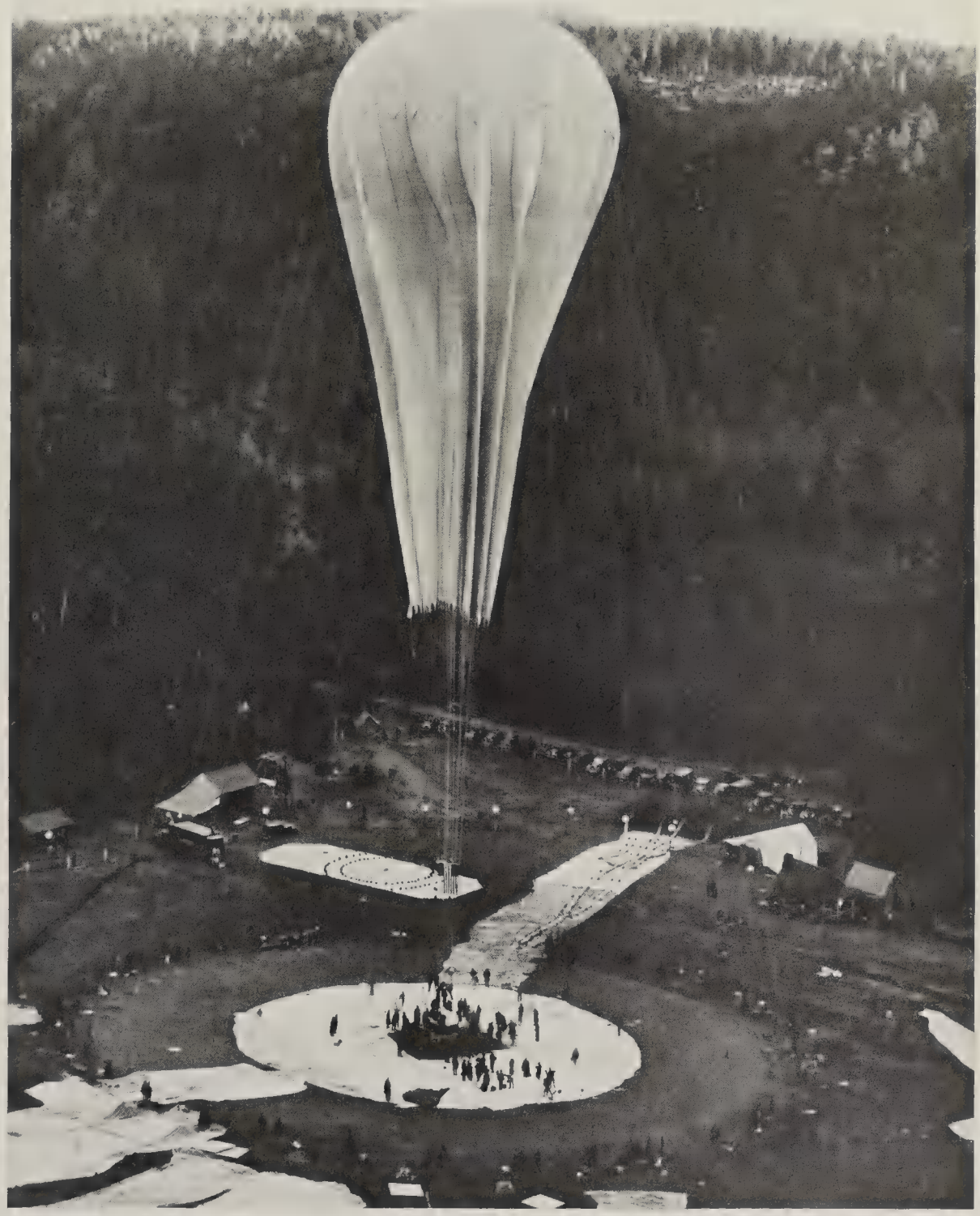
We borrowed an ax and cut through the few uncracked areas, removing sections of shell. Inside, the instruments of which we had been so proud were a heart-breaking mass of wreckage.

We realized, however, that since we had registered almost all of our records photographically, there still were chances that some of the recording negative could be salvaged. So we removed every roll of film we could find, and quickly wrapped it to prevent further damage by light. Happily, as the weeks have passed, preliminary reports from the several scientific laboratories have somewhat dissipated the dark picture we first built up in our minds.

The spectrograph, which Major Kepner and Captain Anderson cut loose before the balloon exploded, was set down by its parachute as gently as if it had been handed to a skilled workman. All of its complicated and delicate mechanisms were in perfect condition, and continued to operate on the ground. Its photographic record was complete and intact, and, in the opinion of Dr. Brian O'Brien, of the University of Rochester, who supervised the construction of the instrument, the film will disclose valuable scientific information.

This spectrograph was designed to make a study of a definite portion of the spectrum of direct light of the sun, to note differences in the spectrum that might appear as the instrument rose above the earth and received the sun's rays through atmosphere progressively less and less dense.

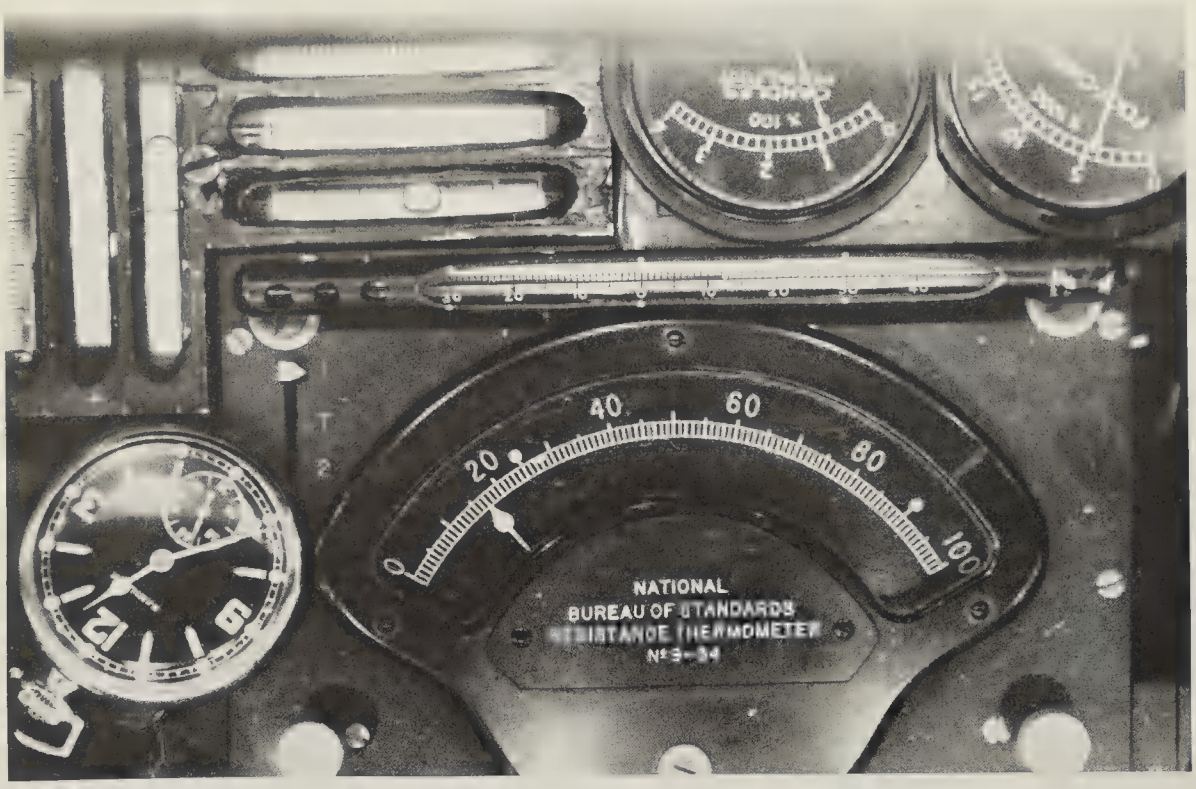
It was expected that the variations in



Photograph by Richard H. Stewart

POISED FOR ITS CLIMB INTO THE SKIES

At dawn on July 28 the gondola had been fastened to its supporting ropes and the *Explorer* was about ready to take off for the stratosphere. The faint lines extending diagonally downward from the upper catenary band are the double tethering ropes. A few minutes after this photograph was taken, these ropes were pulled through their eyelets and dropped, leaving the weight of the gondola and a few hand ropes attached to it holding the balloon to earth.



CAMERAS TIRELESSLY "READ" INSTRUMENT DIALS DURING THE FLIGHT

One of hundreds of records made by automatic cameras as the balloon rose into the stratosphere. This reading, made at 12:36, when the gondola is known from the barograph record (see chart, page 431) to have been at an altitude of 43,000 feet, shows the temperature of the outside air to have been 70.1 degrees below zero, Fahrenheit. (This is found from the scale reading, 17.) The photograph also shows a sun brightness of 4,500 foot candles (the instrument not pointing directly at the sun); a sky brightness of 80 candles per square foot; a temperature in the gondola of 12 degrees centigrade (53.8 degrees Fahrenheit); and a gondola tilt of 1.3 degrees in one direction and .4 degree in the other.

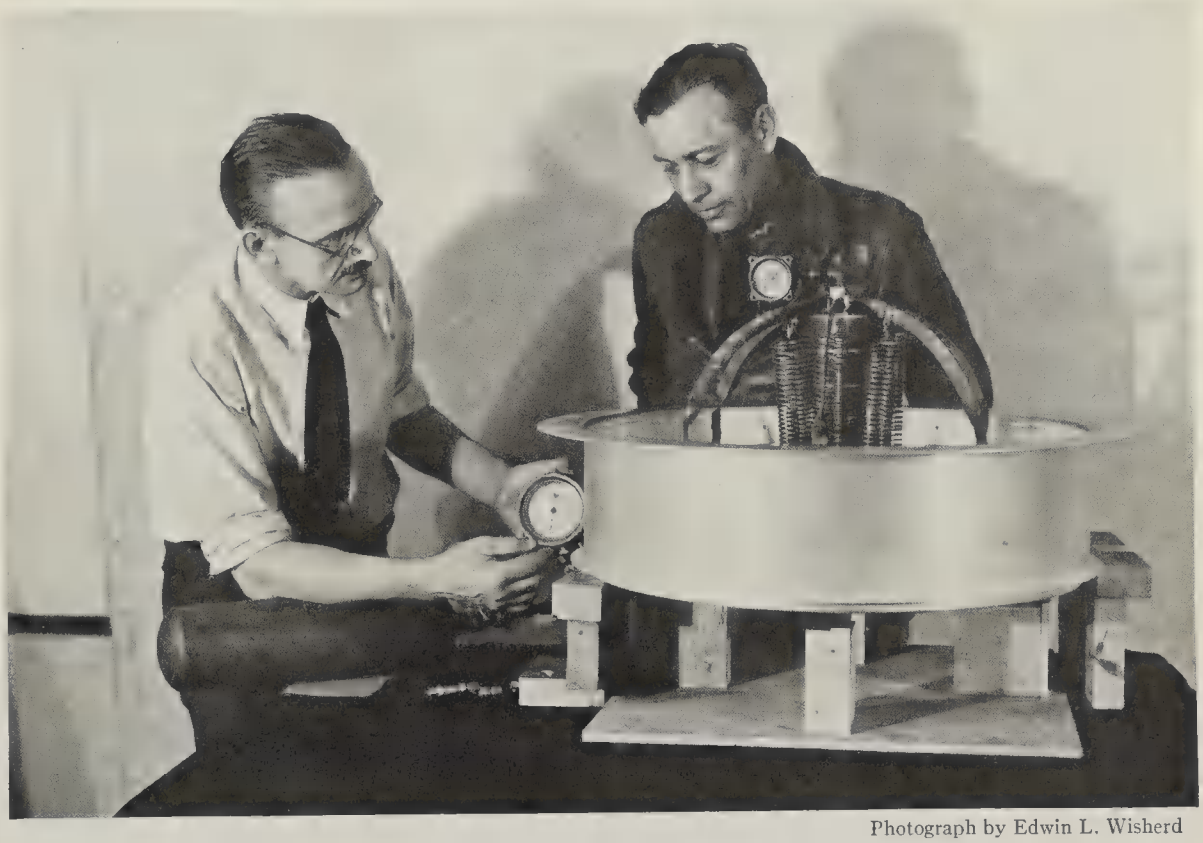
the spectrum would be effected chiefly by changes in the amount of ozone the sun's rays had to penetrate to reach the spectrograph, and that the record would thus give added knowledge of the ozone layer of the upper air. That layer, though invisible, screens out some of the active ultra-violet rays of sunlight as effectively as if it were a black bank of clouds, and so plays a vital part in making it possible for the earth to support life.

FILM RECORDS SALVAGED

Inside the gondola, two other spectrographs, furnished by the University of Rochester and the Bausch and Lomb Optical Company, were badly crushed by the fall. The films were salvaged, however, and when they were developed it was found that considerable portions of the record were legible. If sufficient data were saved, it is possible that the laboratory measurements originally planned can be made, and by study of the combined records of two of the spectrographs new information may be obtained regarding the distribution of ozone and the height of its center of concentration.

On the hanging spectrograph were strung small quartz tubes containing ten kinds of spores furnished by Dr. Fred Meier, of the Department of Agriculture. In spite of their rough treatment, including intense cold, thin air, and the blazing sunlight of the stratosphere, these spores suffered no harm, for they continued to grow as fast as ever when they were returned to a laboratory in Washington (see illustration, page 433).

Three special electroscopes, furnished by the California Institute of Technology, were carried on shelves within the gondola. One was unshielded, one had a shielding layer of four inches of fine lead shot around it, and the third was surrounded by a six-inch layer of lead shot. All three instruments were badly crushed and their film rolls were exposed in varying degrees. Two



Photograph by Edwin L. Wisherd

THIS VALVE, A NEW INVENTION, LITERALLY WAS A LIFESAVER

Because the valve at the top of the mammoth balloon was 300 feet from the gondola, and a rope between the two points might easily become entangled, Captain Stevens (left) devised a compression valve to release hydrogen gas. The device performed perfectly no less than 150 times during the flight, through nearly 400 feet of hose (page 410). Captain Anderson watches the test.

Photograph by Richard H. Stewart

TESTING THE GONDOLA'S AIR SUPPLY

The apparatus shown, consisting of tubes and flasks of chemicals, was used to check the amounts of carbon dioxide and oxygen in the air of the globe when three men were sealed in it and when the device for removing the carbon dioxide was in operation (see text, page 432).

Photograph by Lieutenant Phillips and Master Sergeant Gilbert

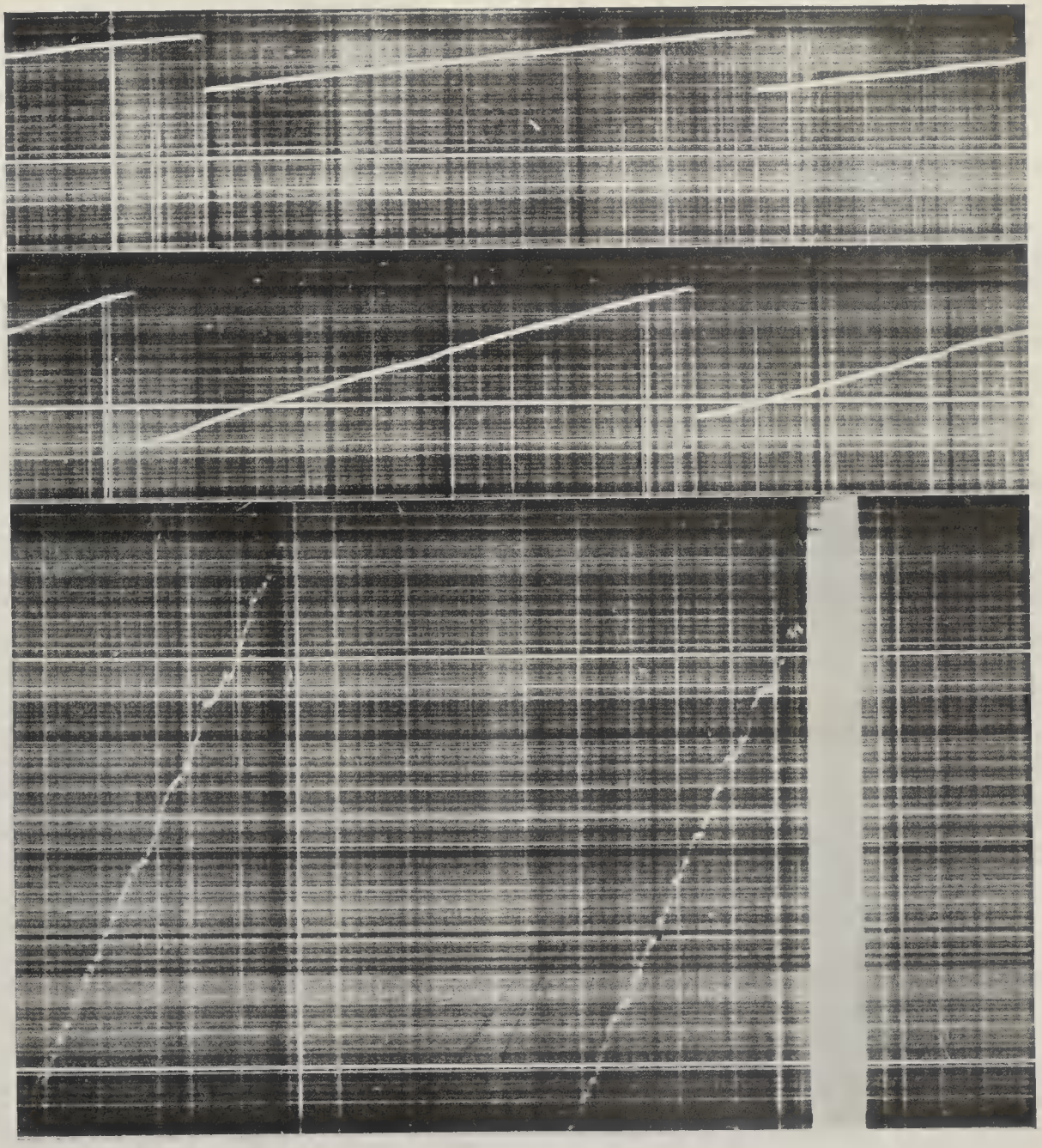
THE "EXPLORER" COMPETES FOR SKY SPACE WITH ANOTHER SPHERE

The moon, only a little past full, had shone down on the Stratocamp through the night, and still hung well up in the west when the balloon rose. In this photograph the bag is at an elevation of 15,000 feet and has expanded slightly. Major Kepner and Captain Stevens have just started to lower the heavy spectrograph (see text, page 405, and illustration, page 399).

of the rolls were utterly ruined. The third was fogged at one end, but the rest of it showed an excellent, clear record (see illustrations, page 423).

Only a balloon the size of the *Explorer* could take up apparatus as large as these instruments. The electroscope, for example, surrounded by six inches of lead, weighed nearly six hundred pounds. Such thickness is necessary to obtain certain data on the penetration of cosmic rays. No matter how small an electroscope can be made, a sphere of lead six inches in radius around it is still more than any sounding balloon can carry.

For cosmic ray investigation it is highly desirable that a balloon be leveled off for certain periods at different altitudes during the flight. This seems possible only with a man-controlled balloon. While it is more costly to use a large balloon, certainly more information can be gathered in a single flight than is possible with many small balloons. If the cost per pound of scientific apparatus carried be considered, then



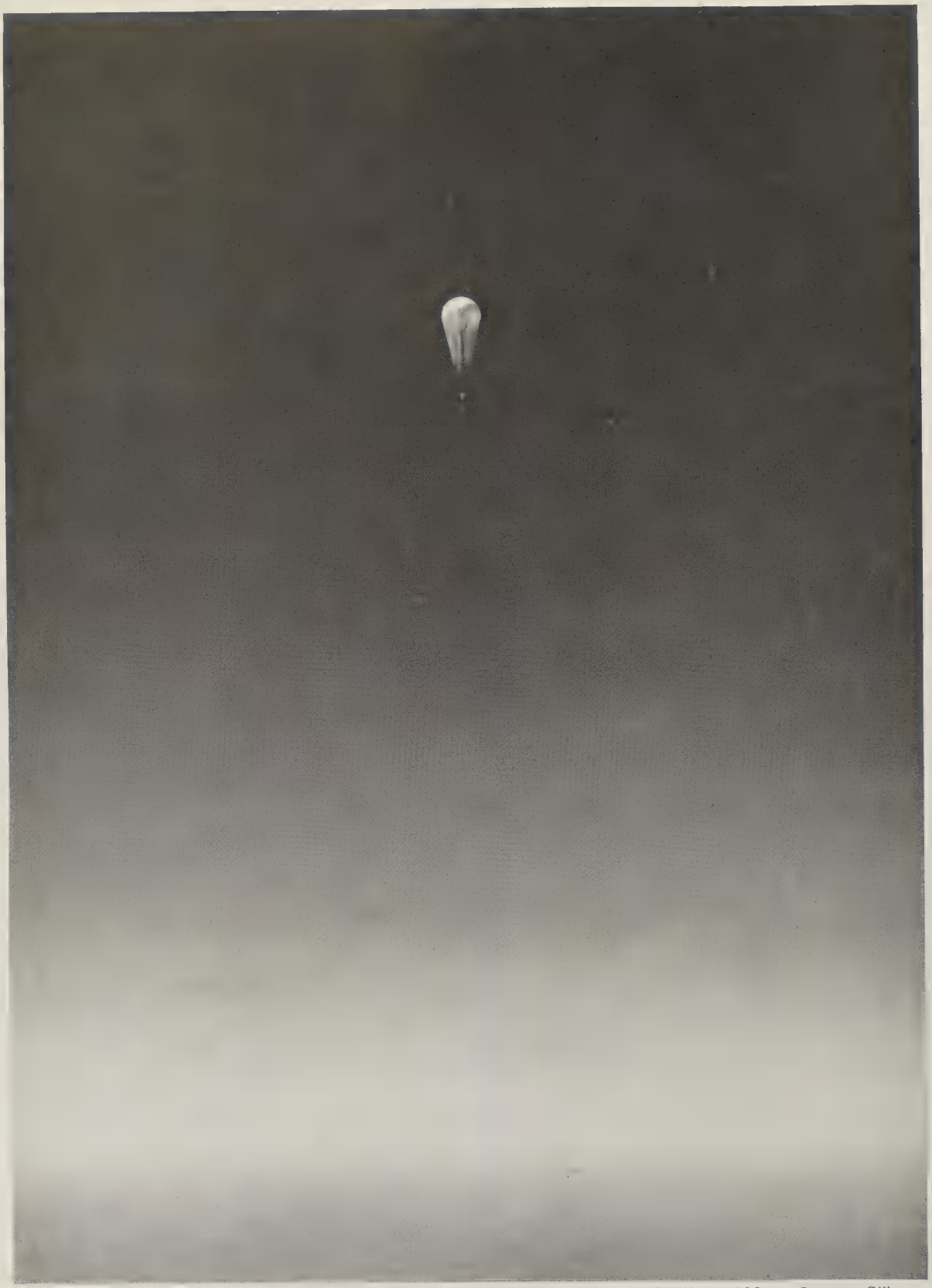
HOW COSMIC RAYS WRITE THEIR AUTOGRAPHS

These enlargements of photographic records from one of the three electroscopes furnished by Dr. Robert A. Millikan, of the California Institute of Technology, show the increasing intensity of cosmic rays encountered as the balloon rose. The space (right to left) from the beginning of one white line to the beginning of the next represents five minutes. The increasing slope of the lines indicates the greater intensity of the rays penetrating the instrument. The upper tracing was made at ground level before the flight, the middle record at about 40,000 feet above sea level, and the bottom record near 60,000 feet (see text, page 420).

the flight of a large balloon is not unduly expensive.

THE STUDY OF COSMIC RAYS

Our elaborate Geiger counter apparatus was built by Dr. W. F. G. Swann and Dr. G. L. Locher, of the Bartol Research Foundation of the Franklin Institute (see text, page 410). This apparatus was the equivalent of an assembly of electrical telescopes so mounted that cosmic rays could be counted coming from the vertical, from the horizontal, and from two angles between. To use this apparatus and the electroscopes of Dr. Robert A. Millikan and Dr. Victor Neher, the balloon was brought into equilibrium at 40,000 feet and allowed to drift at that altitude for more than an hour. It



Photograph by Lieutenant Phillips and Master Sergeant Gilbert

ON ITS WAY!

The airplane from which this photograph was taken has reached its ceiling at 25,000 feet. The balloon is at 30,000 feet and is ascending 600 feet per minute. The bag is approximately one-quarter full. (At an altitude of 60,613 feet the hydrogen had expanded only down to the lower suspension band. Full inflation would have come at about 65,000 feet.) Below is the sun-lighted surface of South Dakota and, just above, is the haze-laden horizon. The balloon is strongly lighted, but the stratosphere air beyond it—clear, thin, and free from moisture and dust—does not affect a photographic negative as does air near the ground. The photograph shows that, photographically, the scattered light gets weaker and weaker toward the zenith. At 60,613 feet the sky was black to the eye as well as to the camera, when looking almost straight upward. At 45 degrees upward the sky was a dark blue in color.

was planned to do the same thing at 60,000 feet and at 75,000 feet.

While in equilibrium the gondola was turned constantly so that the counters could be pointed successively to all positions of the compass.

To accomplish this, we had mounted, on a 14-foot arm, a fan for revolving the balloon. When we first closed the motor switch at 40,000 feet we were pleased to note how quickly this fan started the balloon into rotation. Actually we had to stop the fan from time to time to prevent too rapid turning.

Dr. Swann's apparatus suffered most in the wreck of the gondola. The housings collapsed, the delicate radio tubes and counter tubes were crushed, and the photographic records were exposed to daylight.

Later, these records were carefully developed by the Eastman Kodak Research Laboratories and it was found that more than half of the readings made at the 40,000-foot level were legible. When considered in connection with other data available from the Bureau of Standards instruments, the recovered records may increase our knowledge of the direction of cosmic rays.

The two sealed barographs, hung outside the gondola, were to determine officially the altitude reached. Packed in balsa wood boxes and held in place by a thick insulation of sponge rubber, they suffered scarcely any damage (see illustration, page 432, and chart, page 431).

The curve plotted from the tracings made on the smoked cylinders of the barographs gives an accurate record of the altitude at every minute during the 9 hours and 57 minutes of the flight. It shows that we reached an altitude where the barograph readings corresponded to a pressure of 51 millimeters of mercury. The normal pressure at sea level is 760 millimeters.

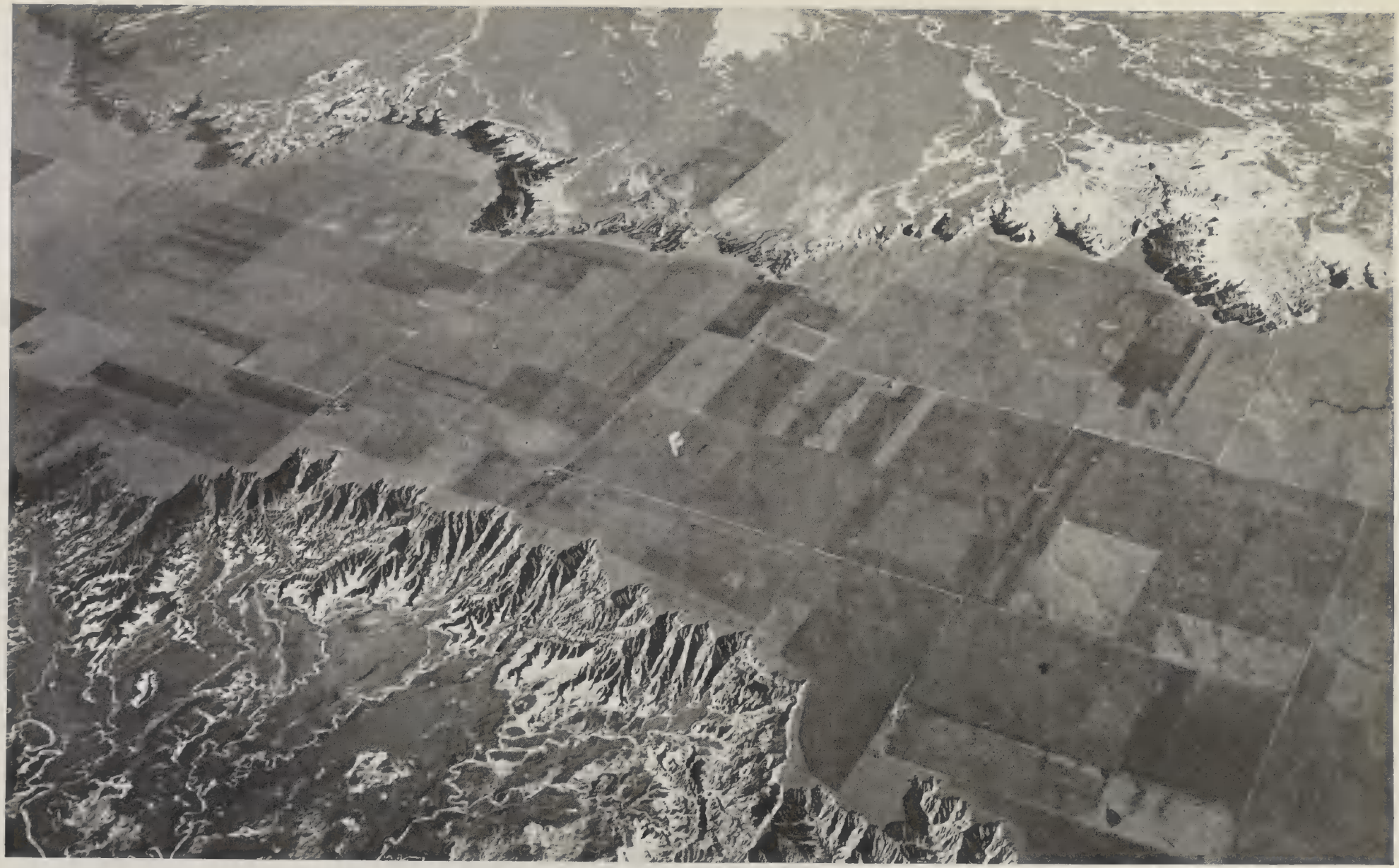
According to the calculations of the U. S. Bureau of Standards, 51 millimeters of mercury, at the temperature prevailing, indicates an altitude of 60,613 feet above sea level. This was only a trifle more than two of our balloon lengths short of the official world record of 61,237 feet, held by Commander T. G. W. Settle and Major Chester Fordney.

By 624 feet, then, we missed equaling the highest balloon ascent made in the Western Hemisphere! Had the rip not occurred, it is probable that the balloon would have risen at least an additional 15,000 feet.

Photograph by Lieutenant Phillips and Master Sergeant Gilbert

AT THE THRESHOLD OF THE STRATOSPHERE

The *Explorer* was seven miles above the earth when this photograph was made from an airplane over northern Nebraska.



Photograph by Lieutenant Phillips and Master Sergeant Gilbert

RISING ABOVE SOUTH DAKOTA'S SCENIC BAD LANDS

Beneath the balloon are fertile fields, but at both edges of the narrow strip of farms the eroded ground has been cut away as if by a malicious giant with a huge chisel.

A STRATOSPHERE VOYAGER NEARS ITS END

The *Explorer,* at an elevation of 8,000 feet over Nebraska, is falling at a speed of approximately 700 feet a minute. The torn fabric from the bottom of the bag hangs down until it touches the gondola, a hundred feet below. The Platte River is shown in the middle distance.

Photographs by Lieutenant Phillips and Master Sergeant Gilbert

THEN THE BOTTOM DROPPED OUT!

The balloon, now at 7,000 feet, is little more than a gigantic parachute. The fabric of the bottom has torn loose almost completely around the bag. It is held only by a narrow strip on the right, and by the ropes that support the gondola.

Photograph by Lieutenant Phillips and Master Sergeant Gilbert

HURTLING GONDOLA, FRAYED REMNANTS OF THE BAG, AND TWO PARACHUTES

Immediately after the explosion of the balloon, the gondola is falling with unrestrained speed. Only an open sleeve of cloth is left of the huge bag that rose into the stratosphere. One parachute is visible just above the remains of the balloon. Another appears near the top of the picture. Between them are numerous fragments of fabric blown out when the bag exploded. The gondola is about 800 feet above ground.

Photograph by Lieutenant Phillips and Master Sergeant Gilbert

FLIGHT'S END—AND A CLOUD OF DUST!

Here in the drought-parched cornfield of a Nebraska farm, near Holdrege, the gondola crashed to earth. The photograph was made from the accompanying U. S. Army airplane at the moment of impact (see text, page 417). The ring of dust caused when the globe struck is just rising. The balloon had burst less than a minute before, and fragments blown out by the explosion can be seen floating downward. The parachutes of two of the balloonists are still in the air above and slightly to the right of the fallen gondola. In the adjoining field to the right is the spectrograph, which was cut loose with its parachute and came down without damage. The smashed gondola is covered by the sleeve of balloon fabric which remained attached after the explosion.

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A NEBRASKA CORNFIELD BECOMES A WORLD NEWS CENTER

Telegraph, radio, and printing press made Reuben Johnson's farm, near Holdrege, Nebraska, on which the *Explorer* came to earth, known to millions of people. Within five minutes after the crash, hundreds of sight-seers were crowding around the wreckage. Captain Stevens, in canvas flying suit, is directing the salvage of the crushed instruments. Lieutenant Phillips, who landed his plane in an adjoining field immediately following the crash, helps with the work. The crushed metal ball and the tangle of ropes that supported it appear at the right. A large section of the balloon fabric lies in the left foreground.

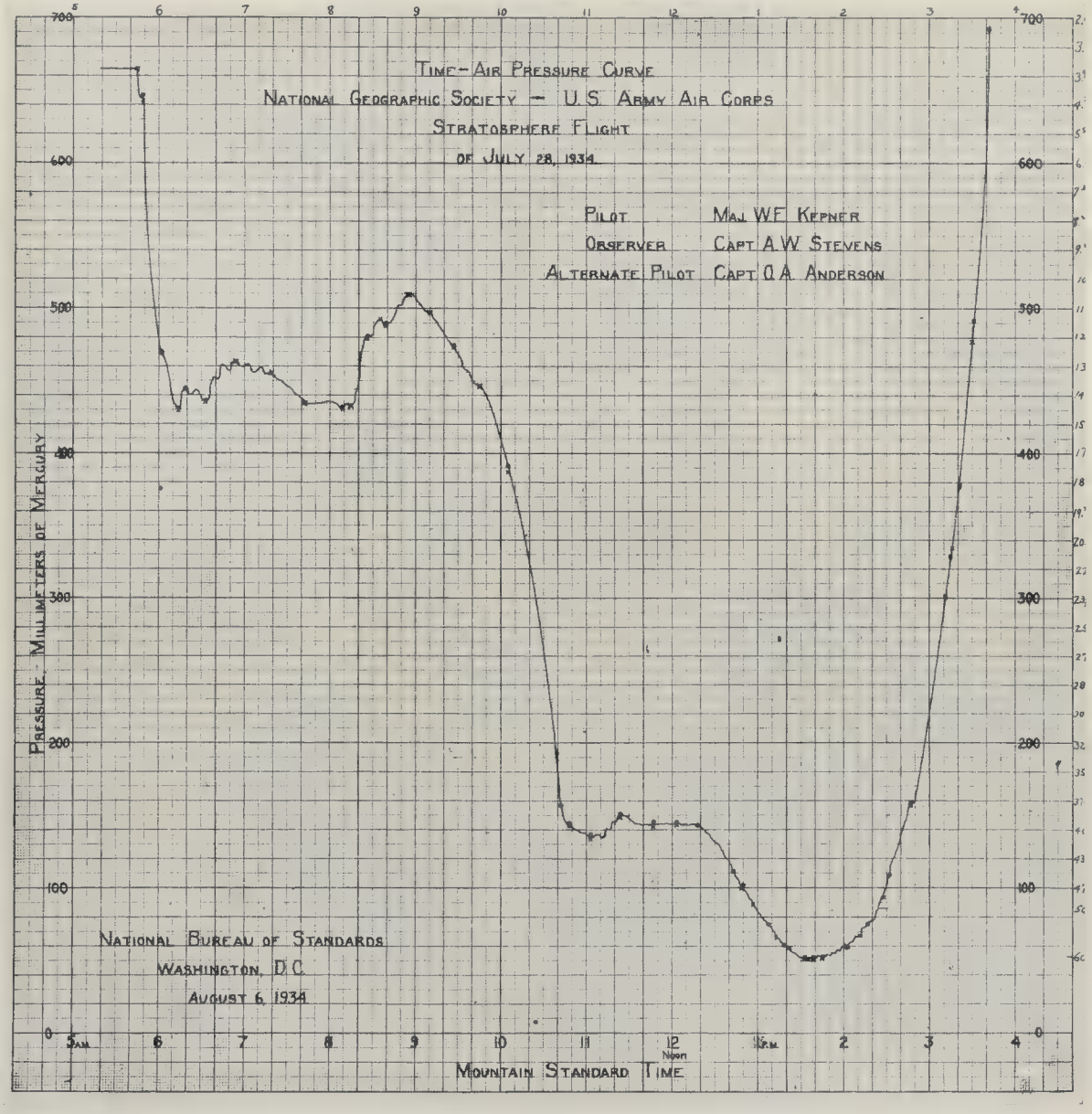
The perfect barograph record of our flight was, indirectly, a valuable bit of salvage. It permitted us to solve some practical puzzles and deduce still more scientific data.

TEMPERATURE DATA ARE OBTAINED

On one of the salvaged photographic records part of the pressure information was missing, but the time and the temperature of the outside air were shown clearly. The time record was common to the separate records of pressure and temperature, so we were able to construct a table and a curve showing how the temperature changed with the changes in altitude. The same photographs which gave us the outside temperature readings also provided a record throughout the flight of changes in sun and sky brightness and of temperature inside the gondola.

Temperature falls rather rapidly as one leaves the earth's surface, and at 20,000 or 25,000 feet it is sure to be below zero, Fahrenheit, even in summer time. As one ascends still higher the temperature drops even faster, until it gets down to about 75 degrees below zero, Fahrenheit. After that the air gets gradually warmer. This turning point, or inversion of temperature, occurs about 50,000 feet above the earth's surface.

Our records showed this turning point, and, above it, the increase in temperature that was to be expected. However, our instruments showed that the temperature dropped at a faster rate between 20,000 feet and 35,000 feet than the average of other observers. Our original plans were to plot the temperature readings from the resistance thermometer and those from the mercury barometer against altitudes calculated from measurements of aërial photographs made of the earth's surface directly beneath us.



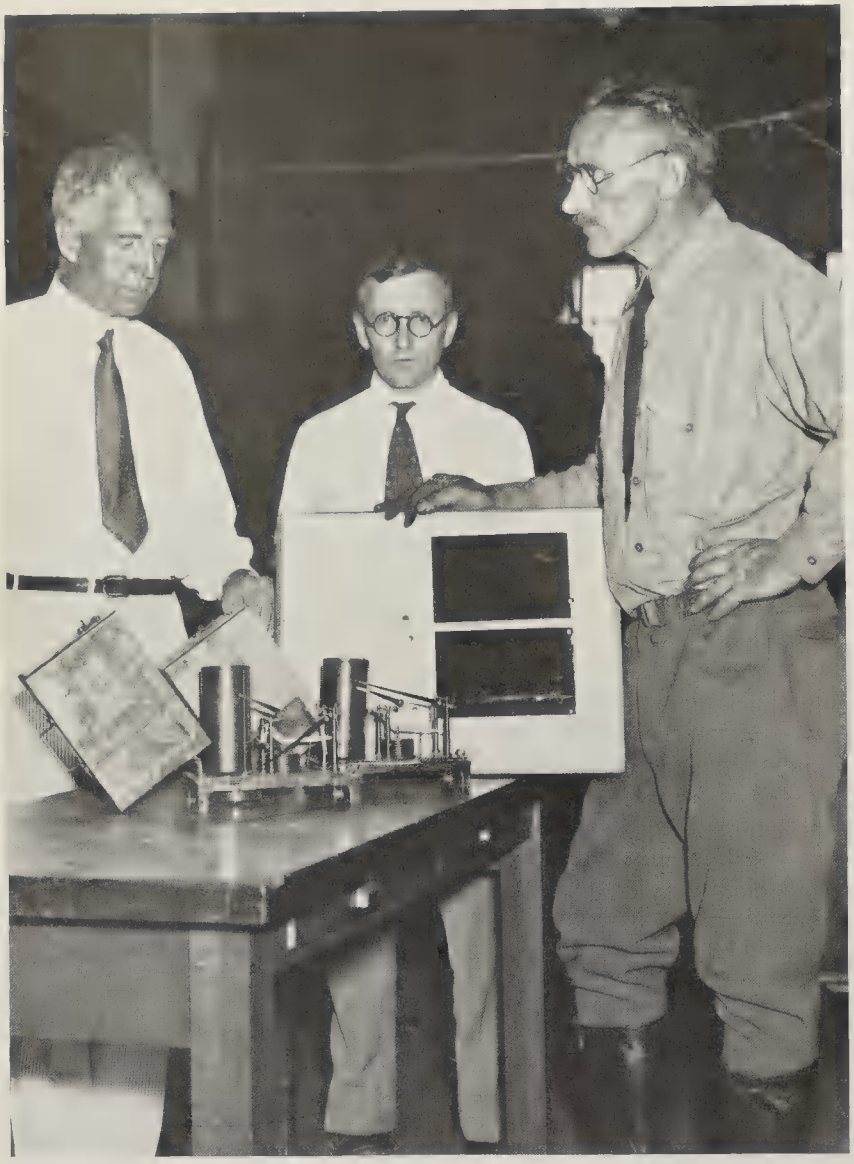
THE BALLOON'S OWN STORY OF ITS FLIGHT

The black curve has been plotted on paper to reproduce the lines automatically traced on the smoked drums of the two official barographs, carried on the flight, as changing altitude affected the instruments' needles. The figures on the margin, from left to right, denote hours, mountain standard time. The figures from bottom to top denote atmospheric pressure in millimeters of mercury. Lighter figures in the right margin show approximately corresponding altitudes in thousands of feet. For quick reading this diagram is best understood by turning it upside down. The upward curves of the line will then denote the rise of the balloon, the downward curves its descent. It will be noted that the barograph was set working at 5:19 a. m.; that the balloon rose at 5:45; leveled off at about 15,000 feet at 6:15; reached 40,000 feet at 10:50; started down from 60,613 feet at 1:40; and crashed at 3:42.

Pointing through the bottom of the gondola was a Fairchild aërial camera to provide the photographs for our calculations. Its negatives were intended also to show the position and altitude of the balloon at all times, its rate of ascent or descent, the direction of drift, and the velocity of air currents.

Unfortunately, the aërial camera magazines were broken wide open by the fall and the negatives on red-sensitive film were a total loss. However, the idea of ascertaining accurate altitude in this way is sound, for it is not difficult to measure points on the negatives, measure corresponding points on maps, and from this information compute true altitude.

Once we determined the altitude optically, we could compare it with the height of the mercury column in the barometer,



METAL FINGERS THAT WROTE THE AUTOMATIC ALTITUDE LOG

Beside the two uncovered barographs are Dr. Lyman J. Briggs, Director of the U. S. Bureau of Standards and chairman of the Advisory Board for the flight; Dr. W. G. Brombacher, specialist on altitude instruments; and Captain Stevens. The smoked drum sheets are held by Captain Stevens. The barographs were packed in a balsa wood box and were insulated by sponge rubber. The box was carried outside the gondola and suffered little damage. The records were intact.

as recorded on one of our three Factograph instrument cameras.

Evidence is available from similar apparatus used in airplanes, and from triangulations on Piccard's balloon with theodolites, to indicate that altitudes computed from existing pressure-altitude tables are too low for great heights. Increased accuracy in records of altitude, pressure, and temperature would make possible more accurate calculation of the distribution of the mass of our atmosphere.

When the rip in the bag occurred, the *Explorer* continued to ascend slowly for nearly twenty minutes longer. During that time it was possible to fill all the air-sample flasks and to take nearly twenty exposures with an aërial camera mounted to point eight degrees below the horizon line.

Our experience on previous high-altitude flights in photographing Mount Aconcagua (Argentina), Mount Rainier, and Mount Shasta across distances of 300 to 331 miles indicates that these negatives should have shown the curvature of the earth's surface. Such negatives are made on red-sensitive and infrared-sensitive film through a red filter. While the yellow-sensitive film of the small instrument cameras exposed to daylight was protected by a few turns of the film itself, the red-sensitive film of the aërial cameras continued to fog for some distance through the roll; therefore, when this film was exposed to daylight by the crash, it could not be saved.

Although many of the photographic records were lost, and although the balloon did not attain its maximum theoretical altitude, we feel that the ascent has definitely added information that will assist in solving problems of ballooning and in the acquisition of needed scientific data.

One important problem was the matter of a satisfactory air supply.

We had inspected our gondola time and again for possible air leaks and had tested it several times under pressure. We carried a large reserve of liquid oxygen and liquid air sufficient to renew the air of the gondola completely four times. Even when used

generously, this was more than enough to keep us supplied with good air from dawn till dark (see page 421).

Our liquid-air apparatus consisted of three vacuum-insulated containers of the kind used in high-altitude airplane flights of the Army. On airplane flights such containers are filled with liquid oxygen. For use in an enclosed gondola it is not safe to use pure oxygen because there is a possibility that the oxygen content of the gondola might approach 100 per cent, in which case an electric spark might start a fire which could not possibly be extinguished.

Consequently, we made a somewhat radical departure by partly filling each of the flasks with liquid air and adding enough liquid oxygen to make a mixture of 45 per cent oxygen and nearly 55 per cent nitrogen. This liquid mixture, when evaporated through the coils of our apparatus, gave us an atmosphere of not more than 45 per cent oxygen. The gondola leakage was practically nil, and consequently we had to release pressure from time to time to prevent the gondola internal pressure from rising too high. The air inside approximated that on the summit of a mountain 13,000 feet high, except that it was richer in oxygen.

Photograph from U. S. Department of Agriculture

TINY SPORES DEFY THE RIGORS OF THE STRATOSPHERE

Knowles A. Ryerson, Chief of the Bureau of Plant Industry of the U. S. Department of Agriculture, and Dr. Fred C. Meier, senior agriculturist, show Captain Stevens (seated) a thriving culture of barberry spores that the balloon carried into the stratosphere. These spores, with representatives of nine other types, were exposed to the sunlight, cold, and reduced pressure of the upper atmosphere. All came back to earth alive.

MANY CONTRIBUTED TO SUCCESS OF THE FLIGHT

On the side of the gondola away from the fan, which circulated our air, were steel screens holding chemicals for the absorption of carbon dioxide. The entire set-up was so effective that when the manholes were reopened after many hours no decided change was detectable as we emerged into the outside air.

Our balloon, gondola, and most of the apparatus were made at prices close to the cost of manufacture, and this cost, less than $60,000, although largely borne by the National Geographic Society, was also shared by individuals, corporations, and laboratories interested in the advancement of scientific knowledge. The huge bag, the gondola and the instruments were insured from damage while in flight by Lloyd's, of London.

Photograph by Newton V. Blakeslee

HAPPY LANDING!

The three balloonists return to the home of the National Geographic Society with the parachutes which brought them safely to earth: Captain Anderson, Major Kepner, Captain Stevens.

Perhaps never was a flight conducted so economically, considering its size and scope, nor one in which so many people gave so readily of their funds and time. The Army approved the flight and lent freely of its men, both from the Air Corps and from the cavalry unit at Fort Meade, and considered that the time spent was valuable training for Army personnel. An opportunity also was afforded for practical service tests, in the field, of certain equipment, such as the Army's liquid-oxygen truck.

South Dakota found that thousands of visitors to Yellowstone National Park and other points were attracted to the State by the preparations for the stratosphere flight.

The Chamber of Commerce of Rapid City had generously helped preparations in making our camp ready, even to the point of providing railings to protect the thousands of spectators who day and night looked on from the cliffs that encircled the "bowl."

The generous hospitality of these western people and their coöperation added to the willingness with which the visiting scientists attacked the many problems of installation. Never was there a camp in which so many people, engaged in widely varying lines of activity, worked together more harmoniously.

Our most cheering thought of the recent ascent is that we feel we have successfully solved the problems of living and working efficiently in the stratosphere. It is gratifying to be able to state that not a single piece of scientific equipment attached to the gondola failed us during the flight; every instrument worked exactly as planned. As for the balloon, we think another can be built that will go to its calculated maximum elevation without mishap.

HAITIAN VIGNETTES

By John Houston Craige

Captain, U. S. Marine Corps

TWO young men lolled over the gunwale of a tiny tramp steamer, avidly drinking in the beauty of the scene of tropical loveliness that lay before them.

One was massive, blond, powerful, with huge white teeth and a glass eye three shades darker than the blue of its natural mate. He was ordinarily called "Blink"—a revolutionist, smuggler, gun runner, Louisiana French-Irish. One of those indomitable Americans with a Napoleon complex and an itching foot, he drilled dusky armies and made a name to conjure with on the Spanish Main until his sudden demise in the troubles attendant upon a Guatemalan revolution.

The other young man was tall and lean, with thick shoulders, pale-gray eyes, and a thatch of sandy hair—myself.

The syncopated beat of drums came faintly across the quiet waters of the bay. Blink beat time absently on the ship's rail with his knuckles.

"It draws you, this country," he said. "The Indians called it Haiti, 'The Mountainous.' The French named it Domingue—on their maps. Informally they referred to all their beautiful Creole dominion here in the lap of the Caribbean as 'Le Pays des Revenants.' You might translate that as 'The Country of the Ghosts,' or 'The Country You Are Bound to Come Back To.' I have a notion the French felt that it was a little bit of both.

GHOSTS OF EXPLORER, PRIEST, AND PIRATE

"Ghosts? What a host must walk the jungles and hills over there at night! Columbus, Cortez, Pizarro, Francis Drake, L'Ollonois, Las Casas, Captain Kidd, Toussaint L'Ouverture, Dessalines, Christophe; explorer, conqueror, colonist; buccaneer, priest, pirate, picaroon; saint, slaver, spawn of the devil. What a country!

"This was the capital of a vast French-African empire before Paris dreamed of Algiers. Haiti, Louisiana, Guadeloupe, Martinique. Half a continent and a dozen islands. French aristocrats, African slaves. A sweet, luxurious realm worth the ransom of a dozen kings. The domain of Circe, fascinating, mysterious. Anyone who tried the life here and had to go away spent the rest of his days seeking to get back, even if only to lay his bones in the shadow of one of those big purple hills.

"What made the fascination? Was it the people or the country? Was it French or African, or a mixture of the two? Or was it purely West Indian, something distinct from either? I don't know, but whatever it was, it hasn't lost any of its strength. No man who sets his foot on the shores of this country can ever forget it. You may love it or you may hate it, but somehow you can never get it out of your mind, and the first thing you know you're heading back for more of it. You'll see."

My friend was something of a poet, yet there was cold fact in what he said. At least I found it so. That was a score of years ago; but, one way or another, Haiti has seldom been completely out of my life from that day to this.

PORT-AU-PRINCE, CITY OF CONTRASTS

Around the land-locked bay steep hills towered, horseshoewise, north, east, and south, mounting to incredible heights in the clear tropical sky. It was early morning, but already the ship's iron deck was almost unbearably hot to the touch. Ashore, mist and shadow still shrouded valley and mountain side, while the first rays of the sun just commenced to gild the roofs and pinnacles of the buildings of the town along the bayside.

The city had an air of beauty and ugliness, naïveté and mystery, magnificence and squalor. It attracted and repelled. The breeze brought to our nostrils languorous tropical perfumes mingled with stenches. There was a sinister suggestion of menace in the hushed streets. Revolution and war brooded over the place. Occasionally we could hear outcries and the sounds of gunshots. The syncopated thump of innumerable tom-toms floated out to us over the water, blended with the high-pitched buzzing near at hand of bloodthirsty malarial mosquitoes that hung in clouds about our ship as we rocked at anchor.

The lower town lay along a curving, painted bay, like a huge gorgeous fish stranded on a green and white coral shoal, a long, brilliant-hued fish, from ardent

Photograph by Clifton Adams

PORT-AU-PRINCE'S ONE AND ONLY WHARF IS PRIVATELY OWNED

Into this West Indies harbor come many private yachts in winter. American seaplanes make stops on their Caribbean route. Cargo boats bring general merchandise, petroleum, cement, steel, drugs, flour, and lumber. Then they load coffee, cacao, wax, cotton, goatskins, raw sugar, and sisal.

equatorial waters. Close under the Bel Air hills its head nestled, the rising walls of the Cathedral upthrust, like parched gills hopelessly gasping for breath. Ridges of brilliant mango and breadfruit trees marked the green line of its back, following ancient watercourses down past the Champ de Mars toward the Outer Cemetery in leafy masses of glittering emerald and malachite against brown dust and parched jungle.

At the bend of the spine gleamed a scarlet dorsal fin of giant flamboyant trees, big as northern oaks, each clothed from root to crest in a solid mass of crimson bloom. Myriads of iron roofs, some red, some green, some brightly galvanized, reflected the sun like brilliant scales.

South, where the road curved towards Bizoton, a triangle of brightly colored villas added a tail, one fluke nestling in a clump of nodding coconut palms, the other brightly outlined against a rolling eminence.

The year was 1912 and the city was Port-au-Prince. Before that time it had never boasted a Marine garrison, a sanitary inspector, a paved street, or a Chamber of Commerce. A filthy, beautiful, glamorous, appalling city, capital of a unique and fascinating country.

BEFORE THE AMERICAN OCCUPATION

"Better not go ashore," said the captain of our ship. A revolution, it appeared, was in progress. But Blink had business connected with a certain arms shipment and I wanted to stretch my legs.

Revolutions were not a novelty to either of us, and an extra one more or less was rather an attraction. So in due time we found ourselves in a cranky native coracle propelled by a couple of grinning black boys in G strings gliding over the coral-paved waters of the bay through floating refuse of a most unromantic nature.

An all-pervading stench of decayed vegetation and lack of sanitation gripped our nostrils. Our craft nosed silently into the shore. Blink jabbered noisily to the black boys. They grinned and responded at length. Blink said that the Haitian patois was close enough to Louisiana Creole to be intelligible to him.

"End of the run," said he. "The boys say we land here. This is Fort Caca. Means

Photograph by Clifton Adams

HAITI'S NATIONAL PALACE FACES THE CHAMP DE MARS AT PORT-AU-PRINCE

Where this "White House" now stands, the author, on his first visit, saw only ruins (see text, page 439). The Republic's government is administered by a President and two Chambers whose members hold office according to a constitution dating from 1889. The country has been independent since 1804.

Fort Manure. This is all built land. I wouldn't be too curious as to what it is built of. The third Government before the last one put a fort near here to help defend the bay. They were proud of the fort and christened it with ceremony. I don't know if its name would make much of a hit anywhere else, but it seems to be quite all right here. Naïve, these Haitians, what?"

Gingerly we scrambled up the narrow path from the water's edge and picked our way for a couple of hundred yards, until the trail widened out into a street and commercial Port-au-Prince spread before us.

A CRAZY-QUILT OF CONTRAST

Like everything else about the town, this was a crazy-quilt of contrast. Perhaps half of the buildings were of stone and masonry, with walls from 18 inches to three feet thick and heavy iron doors and windows. The other half were of flimsiest wooden construction, mostly unpainted and bleached to a phosphorescent gray by the sun, many of them cocked at the craziest imaginable angles. Here and there along the streets were gaps showing the charred remnants of structures destroyed by fires, ancient and recent.

None of the streets had sidewalks, and as far as we could see not a square yard of paving existed. Close under the fronts of the houses, each street had deep-washed ditches in place of gutters, filled with sewage of all description, while progress in the street itself was rendered hazardous by broken bottles, rocks, deep ruts, and sump holes filled with mud and rubbish.

Along footpaths that twisted a tortuous way around the obstructions of the streets, a throng of women glided. Barefooted and clad in blue denim dresses, they plodded along. A few bore burdens on their heads or guided diminutive donkeys almost buried beneath enormous loads, but for the most part they were empty-handed and manifestly apprehensive.

Not an able-bodied male was to be seen and the iron shutters of places of business were closed. This, said Blink, was because of the impending revolution. Plundering might break out at any moment. Men were

LOCOMOTIVES WHISTLE AND RING BELLS DOWN MAIN STREET OF PORT-AU-PRINCE

This narrow-gauge train, puffing down the Rue Grand, is loaded with sugar cane. The cane is hauled from the fields, through the city streets, and out to the mill.

Photographs by Clifton Adams

"ALWAYS ROOM FOR ONE MORE" ON ANY BUS IN HAITI

With American occupation came leagues of new, good roads, so now automobiles carry men and goods between the capital and many outlying towns and villages. This vehicle is near the Custom-house, Port-au-Prince.

likely to be shot on sight, or, escaping this, were certain to be impressed into one or another of the contending armies.

There were men who were not able-bodied, however, and women also. Beggars sat at every street corner and a throng followed at our heels. Blind men and men with patched eyes, men and women with withered limbs and limbs that were swollen to enormous size by tropical elephantiasis, monsters of all sorts with deformities surpassing the imagination and the pathology of more temperate climes. All of them of an indescribable inky jet.

Drawn by A. H. Bumstead

600 MILES SOUTHEAST OF FLORIDA LIES HAITI

Its 2,550,000 French-speaking Negroes rule the western third of the tropic island of Hispaniola, off the coast of which Columbus' flagship, the *Santa Maria,* ran aground and was abandoned in 1492. At Môle St. Nicolas the Great Admiral landed. Within 20 years was begun the importation of slaves, the seeds of the Negro nation of to-day. Cap Haitien, on the north coast, was the capital in the days when Haiti was a French colony, but now the seat of government is Port-au-Prince, near a region of rich, irrigated sugar lands.

TOM-TOMS LEAD TO THE CHAMP DE MARS

Over all the sun beat down, silent, merciless, interminable. To the visitor its rays seemed to have a solid quality, a tangible substance, a weight. They burdened the shoulders, cramped the heels, deadened the brain.

As we made our way inland, the streets trended gradually upward and the ominous thump of the tom-toms came louder to our ears. Suddenly we came out on an open space several acres in extent. It was evidently a park, but dismally neglected and overrun with the swarming vegetation of the Tropics.

"Champ de Mars," said Blink. Waving to the right, where lay a great charred hole in the ground with masonry and beams blackened by smoke protruding from it, he continued, "Haitian White House, used to be the National Palace.

"Well, I'm leaving you here. Have a good time, but better get back to the ship before dark."

Blink cut off to the right with the assuredness of one who knows where he is going. I continued to follow the road inland.

Presently the street climbed sharply to a deep, mysterious canyon. On either hand rose banks of earth and rock and above them walls of masonry.

Here and there gateways and entrances afforded vistas of parklike grounds filled with a well-ordered profusion of tropical trees and shrubs, while far back from the road discreet glimpses could sometimes be obtained of spacious villas and porticoed residences.

THE ESTATES OF THE WEALTHY

Masses of tropical verdure overhung the walls on either hand and the air was heavy with the scent of frangipani and bougainvillea. Here, evidently, was a quarter occupied by the estates of the wealthy. Fascinated by the charm of the scene, I toiled on, catching glimpses, through occasional windings in the trail ahead, of a noble mountain crowned with green luxuriance.

Photograph by Clifton Adams

"DO YOU BELIEVE THAT COLUMBUS REALLY LOST THIS ANCHOR?"

Visitors to the National Palace, or Haitian White House at Port-au-Prince (see page 437), are shown this rusty relic which, tradition says, was lost when the *Santa María,* flagship of Columbus, was wrecked on a reef in the bay at Cap Haitien, Christmas Eve, 1492. Once it was taken to Paris and pawned, then recovered after much difficulty.

Suddenly a wild and raucous clamor burst from the trail ahead. The ever-present throb of drums swelled into a stuttering roar. Shots rang out. Flames stabbed from the green-bordered trail. Smoke hung in the still air and reports rattled and reverberated. A motley column surged into view. It wasn't in military order, or, in fact, in any order. Disorder was its most salient feature.

It was composed in almost equal parts of Negroes on foot and Negroes on horseback. Hardly any of the Negroes had shoes. Some of them had trousers and smocks of blue overall denim. Some had very few clothes indeed. A few had red pantaloons and blue coats with the round gold-laced caps reminiscent of the French Army. Perhaps half of them had guns of one sort or another. Nearly all had machetes, the long cane knife of the country.

IN THE MIDST OF A REVOLUTION

Foot and horse, clothed and unclothed, surged along together. From time to time the spirit would move one of the warriors with a gun and he would fire a shot or perhaps half a dozen shots in rapid succession. Then he would shoulder his piece or sling it across his back and go on as if nothing had happened.

Another would burst into a cacophony of shouts and cries. Instantly the whole host would take it up. Then the volume would dwindle and subside until time for a fresh outburst. The roar of the drums and the shriek of conch-shell horns were deafening.

I looked for the enemy, but there didn't seem to be any. Everybody was in the best of humor and all acted as if they were having the time of their lives. Eventually I decided it must be one of Haiti's famous revolutions.

As a rule, the natives did not harm foreigners on these occasions, I had heard. But I wasn't sure that all members of this army knew the rules, and so I didn't want to take chances on being the victim to make a Haitian holiday. A hundred yards back I noticed a break in the wall on the right of the road where a modest villa stood. Thinking this might offer an opportunity to

NATIVE GIRLS IN SHORTS ARE STILL AN UNCOMMON SIGHT IN HAITI

Posed by members of an athletic club, this picture represents the most modern group at Port-au-Prince. One might travel over the island for years and not meet another discus thrower.

Photographs by Clifton Adams

AWNINGS AND PALMS ARE THE "WALLS" OF THIS HAITIAN LIVING ROOM

Because of the mild climate, few glass windows are used; even screens are rare, although most people who can afford to do so sleep under mosquito nets. Many of the better homes are floored with imported French tiles; furniture and other household equipment come from France. Illustrated magazines and newspapers of France are preferred by Haitians, whose language is French.

Photograph by Clifton Adams

STRIPPED OF POWER, THE TYRANT CHRISTOPHE FELL HERE IN A PARALYTIC FIT

Downhearted, deserted by most of his former followers, the Black King was stricken in this chapel at Limonade while at Mass on August 15, 1820. His head hit the floor just under the plaque which, translated, reads, "Here fell King Christophe."

get out of the path of the advancing multitude, I made my way in that direction.

Scrambling across a 6-foot ditch, I climbed into the garden of the villa and stood behind a thick clump of shrub, close against the portico of the house. Draped from a veranda were a couple of British flags, which cheered me measurably.

REFUGE IN A BRITISH HOME

I had a feeling of being minutely scrutinized. Presently a bolt grated and a long French window swung open. A carefully groomed colored gentleman dressed in a faultless morning coat made his appearance.

"Better come in, sir," he said. "We foreigners are ordinarily safe in time of disturbance, but one cannot always be certain."

By this time the head of the column, shouting and blazing away, had come abreast of us; so I did not stand on order or ceremony, but accepted his hospitality with much thanks and stepped hastily into the house.

"You are quite safe here, sir," said my host. "The British flag is a firm shield and a sure defense. Allow me," he said gracefully. "I am Ludovicus Tilghman, barrister-at-law, late of London." I told him my name and we shook hands warmly, my admiration for the British Empire rising a couple of notches.

Inside was the typical interior of a British home of the upper middle class. It might have been Chelsea. Copies of the *Times* and the *Daily Mail* were on the table. I learned that my host was a Barbadian who had spent some years in the mother country.

"This sort of thing is no doubt new to you," he said. "You may perhaps enjoy a view of it. We shall see it better if you will permit me to conduct you above." In a spacious living room on the upper floor blinds were tilted discreetly to permit a view and chairs were brought.

"This," said my host, "is the fifth time this has happened in my short residence here. It is a great nuisance. Revolution, and all that sort of thing. Paralyzes business. These people have absolutely no conception of law and order. No Magna Carta, no Bill of Rights. Suffrage a ghastly sham. Trial by jury a joke. Presidents arrive one day and are exiled or assassinated the next.

Photograph by Clifton Adams

"WHAT LUCK?" THE WOMEN SHOUT, AS THE FISHING FLEET COMES IN

Even a vagabond rooster, hunting a fish head, comes down to meet the boats. True to form in Haiti's easy-going life, offshore winds blow the boats out to the fishing grounds every morning, then shift, blowing them home at night (see Color Plate VII).

Only one ruler of this country ever finished his term and got out alive and in peace. The rest were murdered, died mysteriously, took their own lives, or were driven into exile.

"What a country for this civilized 20th century! Upsetting to the whole Anglo-Saxon scheme of life. What they need is a liberal application of the Pax Britannica, don't you think? But I beg your pardon; I presume you are from the United States."

I hastily assured my host that, although I was indeed a Yankee, a little peace, British or otherwise, would do no harm.

I asked about the mob that was defiling outside.

"These gentry are *cacos*," he said. "Mercenary soldiers, bandits, that sort of thing. Some politician gives them a few shillings and promises them loot. They come down from the mountains. A president is driven out and another comes in. They kill a few dozen, a few hundred, or perhaps a few thousand, and loot what they can. Then they go back to their mountains and wait for the next revolution."

When the end of the ragged army passed we returned below. My host proffered coffee. Thunder rumbled in the distance. I arose to go.

"Better not go yet," said my host. "The storm is due in twenty minutes."

"What storm?" I inquired.

"You shall see," said he.

THE DRAMA OF A HAITIAN STORM

On the veranda the air was thick, still, and oppressive. Far above the head of the valley up which our road ran, inky clouds shrouded the mountain side. Where we stood the sun shone brightly and the trees hung motionless, but an electric tenseness gripped the atmosphere. On the steep sides of the mountain black masses of clouds whirled with frightful velocity, enormous streamers of mist separating themselves from the parent body and driving this way and that like gray curtains.

Athwart the rays of the sun, torrents of rain descended on hilltop and valley thousands of feet above.

As we stood, the first huge drop of the storm fell in the dust at our feet with a plop, leaving a wet spot as big as a silver dollar.

At the bottom of the 7-foot chasm that served the road in place of a gutter a foot of water hissed and boiled where dry rocks had been 15 minutes earlier. A thin stream trickling from above twisted and writhed through the dust in the road.

Rain drops pattered thicker and faster. The light of the sun grew pale and sickly. At length, with a blinding flash and earth-shaking reverberations, the storm burst upon us. An icy wind rushed down the mountain side. Lithe, elastic palms whipped almost to the earth, while massive mangoes and oaks labored and groaned. The sky opened and water crashed down in torrents. Lightning flashed above a cannonade of thunder. Balls of fire streaked down from the heavens and ran along the ground, dazzling the sight and bursting at last in unbearable effulgence.

In spite of their depth and capacity, the gutters at each side of the road soon filled to the brim. Before long the road itself was covered with a foot of water. Soon it was three feet. Tree trunks and carcasses of pigs and goats swept by. A horse and man came swirling along.

Then, with a final orgy of lightning and a roar that seemed to split the skies, the storm departed as quickly as it had come.

My host drew out his watch. "Five o'clock," he said. "Just on time. Ought to be 5:15 to-morrow. You have still an hour of daylight to regain your ship."

Down the steep road and past the ruined palace of the Champ de Mars I made my way, overtaking Blink, also hastening seaward.

A LINE OF SHACKLED LOSERS

The revolution, like the storm, had passed over the town. Bands of native warriors wandered in the streets. Everywhere shutters were closed tightly and the flags of foreign nations fluttered from nearly every balcony. It did not seem that there could be so many aliens in the city. As we made our way to the water front, we passed a line of half-naked Negroes tied neck to neck with straw ropes and guarded by a dozen barefoot soldiers.

"Losers," said Blink, carelessly. "They belong to the President's army. Or maybe they are the enemies of somebody on the winning side. They take them right down there a piece and shoot them. Then they push them into the swamp."

Despite the fate in store for them, the captives did not seem depressed. They chattered and begged cigarettes from us. Occasionally the guards would fall to beating one of the captives with their gun butts or clubs.

Back aboard the ship we found that two new passengers had come aboard—a small, heavily bearded Frenchman and his charming Parisian wife. He was the editor of a French paper and was writing a book on Haiti. He was brimming with enthusiasm and spoke English fluently. He told of terraced gardens he had visited, magnificent villas, books, music, beauty and gayety, spotless napery, gleaming glass and silver—all the refinements and delights of civilization.

WHY HAITIANS ARE DIFFERENT

This didn't sound like the Haiti I had just seen. I asked him about it. He chuckled a bit, then looked thoughtful. Yes, he said, he knew about the things I had seen. They were all part of the picture.

"To understand this country," he said, "you must begin by comprehending two things: first, the origin of its people; second, its isolation. Consider, *mon ami.* We French brought here thousands of black slaves, savages from the Congo. They cross-bred with colonial whites—some able whites, aristocrats, the best blood of France. The mulatto caste grew up. Ah, there's a fascinating study for you!

"Old Papa Mendel taught the world's biologists that when you mix two races you are likely to pull the most amazing individuals out of the hat. Mix the daughter of a Dahomey chief with a French marquis and you may get a man with the skin of a Cetywayo and the brain of a Talleyrand. You may get a woman with a black skin and a white soul or one with a white skin and black mentality. What possibilities for variety, drama, suffering!

"For the hundred years of Haiti's independence this mixing has been going on in isolation from the rest of the world. A caste of intelligent, highly educated mulattoes grew up, and beneath them a caste of primitive, black, transplanted Africans. Each caste reacted on the other, and in the passage of time members of each caste grew to be different from any other people in the world—Haitians.

"The mulattoes were French in language and education, but they absorbed from the blacks much of their African mysticism and

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Natural Color Photograph by Clifton Adams

CHRISTOPHE'S CITADEL DEFIED THE FRENCH—WHO NEVER CAME

His Black Majesty needlessly crowned the 2,886-foot Bonnet-à-l'Evêque with the impregnable fortress La Ferrière. Today the century-old ruin, like a huge stone battleship stranded on a mountain, lures travelers to a hard three-hour climb up the steep trail.

THIS GAUDY KITE MOANS AND GROANS AS IT DIVES IN AËRIAL JOUSTS

Haitian boys build into their home-made toys of colored paper vibrating vanes that make queer noises. Sometimes they tie pieces of broken glass to the tails and try to maneuver the kites so as to cut the tails and strings of those of other boys.

© National Geographic Society Natural Color Photographs by Clifton Adams

LITTLE BROTHER WORKS A PRIMITIVE CANE CRUSHER

Natives of the fertile district southwest of Port-au-Prince use a mill of one-boy power and one-stalk capacity. The juice is not boiled into molasses or sugar, but sweetens the family coffee. In the crude mortar behind the standing girl, corn and cassava are pounded into rough meal.

OLD GLORY FLIES BESIDE THE FLAG OF HAITI AT THE RACES

Spring meetings, open only to horses raised on the island, were supervised by officers of the United States Marine Corps at Bowen Field, the military airport of Port-au-Prince. Citizens of both Republics mingle in the friendly crowd of devotees of the sport.

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MASKED STRUTTERS REHEARSE FOR MARDI GRAS

Haiti celebrates the beginning of Lent with ceremonies half Latin, half African. In Port-au-Prince exquisitely gowned beauties vie for the crown as Queen of Beauty, but rural joymakers, clad in brilliant costumes and grotesque straw headdresses, dance to the beat of work drums.

© National Geographic Society

Natural Color Photograph by Clifton Adams

COAST PACKETS SUN THEIR WINGS AT WHARF CABOTAGE, PORT-AU-PRINCE

Haiti is a rugged country, and before the American days there were few roads. Scores of roughhewn wooden craft with white, red, or purple sails cruised along the coasts. Now highways have come, and high-speed trucks compete with the ships.

© National Geographic Society Courtesy of Bruce S. Ingram

THE BLACK NAPOLEON, HENRY CHRISTOPHE, ONCE KING OF HAITI

Born a slave about 1765, he became a leader in the Haitian slave uprising. Made president in 1807, and crowned king five years later, he shot himself — tradition says with a golden bullet — in 1820. Painted by Richard Evans, from life, and exhibited at the Royal Academy in 1818.

Natural Color Photograph by Clifton Adams

SOULOUQUE'S GOLDEN CROWN IS SELDOM EXHIBITED

The gem-incrusted relic is usually kept sealed in a vault of the Banque Nationale d'Haiti in Port-au-Prince. A Government official guards the masterpiece of a French jeweler, which, in old prints of the coronation in the forties, is shown on the head of the second "Emperor," Faustin the First.

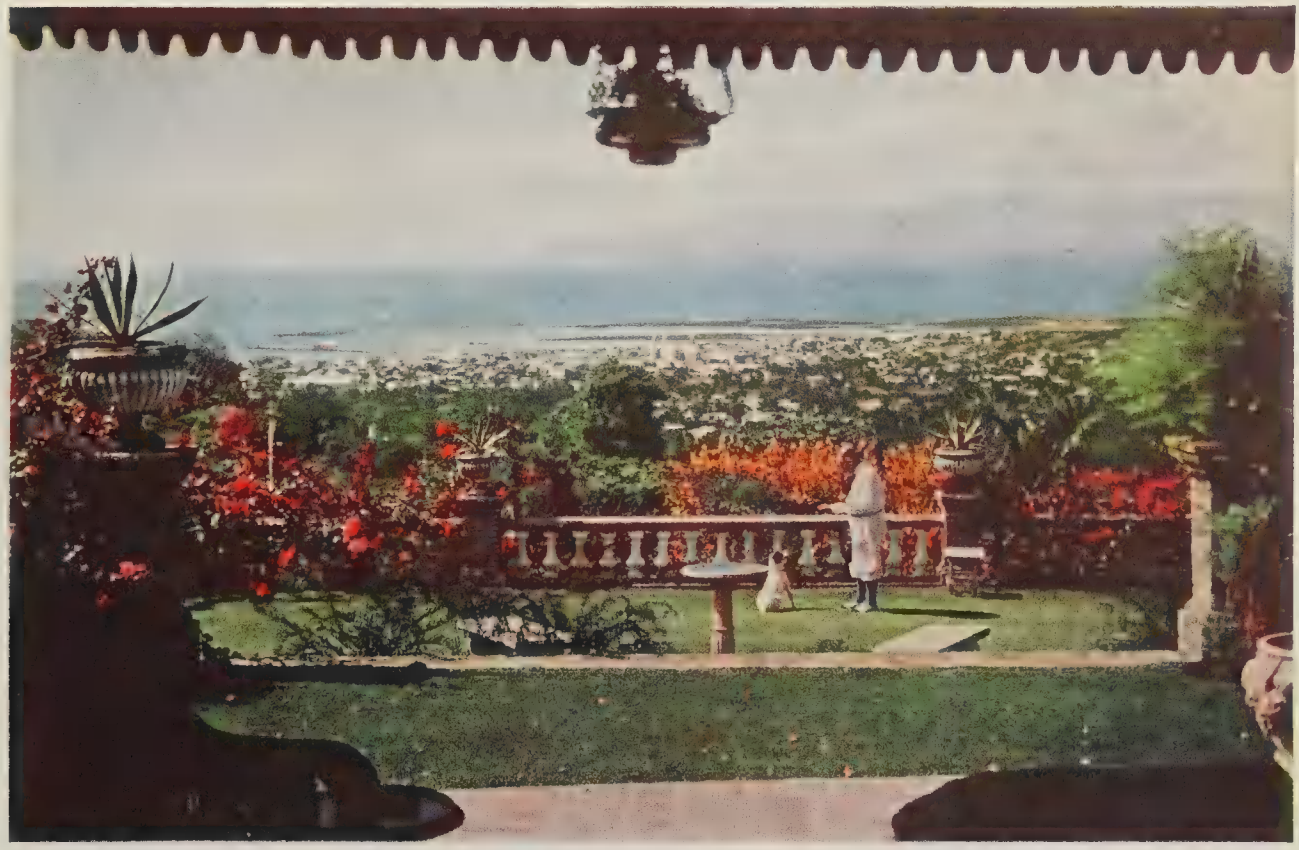
EARLY SHOPPERS RUSH TO HAITI'S "IRON MARKET"

The structure covers about half a city block. It was designed and built in the early nineties by President Florvil Hippolyte, who never tired of admiring the Moorish towers connecting its two parts.

© National Geographic Society Natural Color Photographs by Clifton Adams

BARGAIN HUNTERS SHOP IN SIDEWALK FIVE-AND-TENS

Merchandise of all descriptions is stacked on the pavement in front of stores in Port-au-Prince's poorer districts. Most of the buyers are country women who bring the produce of their small farms to the city for sale. Sometimes they have as much as 50 cents gold for an orgy of spending, but usually a dime or a quarter is their limit.



THE PANORAMA OF PORT-AU-PRINCE BAY RIVALS THAT OF NAPLES

Viewed from the hills where live the city's wealthy and cultured classes, Haiti's capital presents an aspect of breath-taking loveliness. The Presidential Palace may be discerned on the left.

© National Geographic Society Natural Color Photographs by Clifton Adams

EXOTIC COLOR TOUCHES EVEN THE FOOD FISH

Tempting to the eye is the fishwife's offering of red snapper and other delicious varieties, glowing with brilliant reds, blues, yellows, and greens. The wind blows the fleet out to sea in the morning, and, changing, wafts it back with the catch. When the breeze does not turn, native anglers toot horns and beat pans.

© National Geographic Society Natural Color Photograph by Clifton Adams

A BRILLIANT SERVICE HONORS THE ARCHBISHOP OF HAITI

In the rosy twilight of the new Cathedral in Port-au-Prince, President Sténio Vincent, his Cabinet, the diplomatic bodies, and many notables of the capital attend High Mass, celebrating the fiftieth anniversary of the ministry of a revered ecclesiastic.

superstition. The blacks held to their mother religion, the voodoo, and many of their African social customs, but they absorbed in turn a few French words and a veneer of Christianity.

"In the main, the mulattoes held the wealth of the country and all the powers of the government, modified by the propensity of the blacks for periodical revolution and plundering. Neither caste felt any responsibility for maintaining order, sanitation, facilitating business, or paying debts, private or public. The country was chronically bankrupt. Commercial obligations were not worth the paper on which they were written. Epidemics of disease found a hotbed. While the intellectuals produced poems and lived epics, the perpetual tales of uprisings irritated the civilized capitals of the world.

"That is why all this must go. This is an age of standardization, sanitation, uniformity. The world is growing smaller. Haiti's isolation cannot last. The great nations of the world will not permit any small country to maintain what they regard as a nuisance at their gates, however exotic and fascinating its spiritual life may be. In twenty years this country will be cleaned up, civilized. As a poet I deplore it, but as a realist I know that it is inevitable."

Next morning our ship steamed out of Port-au-Prince harbor and soon the towering purple mountains remained only as vague cloud masses on the horizon. With me, however, it was not to be a case of "out of sight, out of mind." As we plowed northward through cobalt tropical waters, the sights and experiences of my day ashore seemed to grow clearer rather than to fade, and to assume a rational sequence until the whole spread out before me like a vast picture, a cunningly wrought vignette etched into the tablets of my memory.

HAITI RETAINS THE FRENCH LANGUAGE

Haiti occupies the western third of the island of Hispaniola, second in size of the Greater Antilles, which lies between Cuba and Puerto Rico. Haiti is the only Latin-American republic in which French is the official language. Its neighbor, the Dominican Republic, which occupies the eastern two-thirds of Hispaniola, thinks and speaks in Spanish.

The Haitian Republic is about 10,204 square miles in area, not quite as large as the State of Maryland. It is made up principally of three ranges of towering mountains, interspersed with fertile alluvial plains, mostly small, and plateaus and valleys (see map, page 439).

The island of Haiti, or Santo Domingo, was the second largest discovered by Columbus on his first voyage. His name for it, Hispaniola, has recently been revived as a distinctive name for the entire island.

In Haiti proper, from 1805 to 1915, 26 men held executive power. These included two emperors, one king, and 23 presidents. One committed suicide, four were killed outright, five died in office, and fifteen were driven into exile by revolutions. Only one retired voluntarily at the end of his constitutional term. He must have been an eccentric, even for Haiti.

U. S. MARINES CLEAN UP THE CAPITAL

One morning at the breakfast table I read headlines that United States forces had occupied Haiti. A president had been killed in Port-au-Prince streets. Debt payments had been defaulted. The French Legation had been violated. Foreign protests rose in chorus.

I remembered my French friend's words. He had been a true prophet. Fewer than 20 years had passed, but the cleaning-up process had begun. The world was emphatic in declaring that Haiti must change her ancient ways. In July, 1915, Uncle Sam undertook the disagreeable and expensive task of seizing her by the slack of her ragged skirts and dragging her into the modernity of the 20th century.

One day I got orders to pack my kit for Haiti. Nearly ten years had elapsed since my first visit to Port-au-Prince, and I knew that many changes must have taken place since Uncle Sam stepped in.

The transport steamed in to Port-au-Prince harbor. Same purple bay; same amethyst hills; same rolling thump of drums. But something was missing from the picture. Where was the stench of yesteryear? Gone, apparently. In its place, only the clean odor of roasting coffee.

The same host of black boys surrounded the ship to dive for coppers, but their boats were different. In the old days these craft were made of logs crudely fastened together, or of huge single tree trunks, hollowed out. Now they were made of packing cases, mostly those which had held gasoline cans. Some of the craft had "Standard Oil" in bright letters on prows or sides. Where

Photograph by Clifton Adams

MARDI GRAS CARNIVAL HONORS ONE OF ITS QUEENS

As in New Orleans and elsewhere, the annual festival in Port-au-Prince is the year's most colorful spectacle. Then merchants vie with each other in the construction and display of ornamental floats; citizens of all ranks, high and low, and many in costume, share in merrymaking.

formerly nakedness had been the rule, now most of the lads wore a garment of some sort. One had a pair of swimming trunks of which he was visibly proud.

Ashore, the harbor front was a mass of concrete buttressed with pilings. Fort Caca and its malodorous mud were gone. Inland and upward ran wide, well-kept streets, each paved with concrete. Sump holes and pools of stagnant water had disappeared. At the sidewalk edges now ran gutters with frequent sewer inlets. Overhead hung electric lights, while gangs of street cleaners plied their brooms with vigor. The beggars with the hideous deformities had disappeared, many of them, I was told, cured by U. S. Navy doctors and sent back to work.

Crowning wonder of all, dozens of automobiles chugged hither and yon. At the time of my first visit there had been none. Inland, where I had seen the charred ruins of the old palace, now rose the white magnificence of a new structure, said by many to be the finest public building in the West Indies (see page 437).

My duties took me to Cap Haitien, about 185 miles north of Port-au-Prince (page 474). I journeyed thither by automobile in eight hours over an excellent gravel road. In the old days there had been only a narrow trail. He who made the trip had to go on horseback and spend at least a week on the way. The road was thronged with country people, men and women, going about their business unconcernedly.

I was struck by the increase in the quantity and quality of the clothing worn. In the old days garments were sketchy enough and nakedness not uncommon in the back districts. Now the men were clothed from neck to knee, and even the poorest of the women had some sort of skirt. Flour and cement sacks, discarded by the Marines, seemed to constitute the latest thing in fashions. At least half the pedestrians seemed to have "Portland Cement" or "Pillsbury's Best" stenciled across some prominent portion of their anatomy. Later, prosperity rose still further and these ex-flour and cement sacks were discarded for more conventional garments of blue denim.

LIKE A PILGRIM TRAIN, MARKETWOMEN ON DONKEYS FILE UNDER THE ARCH

Donated by a native in honor of former President Hippolyte, this structure was a Haitian conception of the Arc de Triomphe in Paris. It stands near the "central" (sugar mill) of the Haitian-American Sugar Company. The sign warns of a 15-mile-an-hour speed limit.

Photographs by Clifton Adams

SUBSTANTIAL HOMES LIKE THIS ARE RARE IN HAITI

Most of the dense population dwells in the shady interior, sheltered in primitive huts of grass or palm leaves. This home, built by an upper-class Haitian, stands in the best residential district of Port-au-Prince.

The older huts were all situated on prominent, exposed hills, but new ones, I noticed, were near wells or on the banks of streams. The reason, I was told, was that the chief requirement of a hut in the old days had been safety for its male occupants. The dwellings had to be so located that their inmates could keep a sharp lookout in all directions to spot the approach of a caco band and make a quick escape to avoid being recruited as members of its force. Now there were no cacos, so the new huts could be placed with an eye to convenience.

But the significant thing, that remains graven on my mind after the passage of years, is the visit I made to the stronghold of one of Haiti's famous rulers.

CHRISTOPHE'S CITADEL DOMINATES CAP HAITIEN

Historic Cap Haitien is situated on a shallow bay on the north coast of Haiti. On a coral reef just offshore, historians believe, Columbus' flagship, the *Santa María,* was wrecked. In the days of the French, the Cap, then called Cap Français, was the capital of the colony (see map, page 439).

As I went about the old town, I was conscious of a strange hump on the skyline to the southeast, many miles distant.

"Oh, that?" said my host. "Christophe's Citadel—the most imposing structure of man in the American Tropics. Why don't you go up to-morrow?"

It lacked two hours of dawn when a servant called me. I had just time for a plunge in my host's basin, the small swimming pool with which every Haitian house of the better class is equipped, and a sketchy breakfast when an automobile entered the courtyard and it was time to be off. Through the narrow streets of the sleeping town I rolled with my companion, young Lake, a lieutenant of the Gendarmerie, the native constabulary officered by U. S. Marines. He seemed to be a perfect encyclopedia on Christophe, and, as he talked, a new image built itself up in my mind of the Negro ruler who had held sway here a century ago.

His was a success story. From a barefoot slave boy he rose to be a ruler of power and magnificence. A despotic and cruel ruler, perhaps, but one who was honest, proud, and courageous. He made his country respected and feared for the first time in its history by the great powers of Europe, the *blancs* (whites). That is why black Haitian lads to-day regard Christophe's memory much as American schoolboys regard that of George Washington (see Color Plate V).

THE "SUCCESS STORY" OF HAITI'S BLACK KING

"Henry Christophe," said Lake, "born probably between 1760 and 1765, came to Cap Haitien from the British island of St. Christopher (the old name for St. Kitts). He ran away on a French ship and was sold as a slave boy in Haiti. He became a French officer's servant and sailed north to take part in the siege of Savannah in our own Revolution. He was a proud, high-spirited lad, intelligent, and quick to learn.

"When the French fleet returned, Christophe was sold to the owner of a tavern, the Hotel Couronne. You can still see the ruins of the place and the big *mapou* tree where the French gentlemen tied their horses. He was a good servant—polite, efficient, obliging. While he waited on guests, he learned what he could from each. In his successful days he often told how he had picked up scraps of helpful information or had acquired useful traits by imitating this or that patron.

"But within him, as he grew to manhood, he began to feel that he was a superior man. He compared himself to the customers at his master's inn, and almost always the balance seemed to be to his advantage. Although he hid his feelings skillfully, he began to hate the system that condemned Christophe, the able, to remain all his life the hopeless servant of any incompetent master who had the price of his purchase.

"He acquired two great motivating ambitions that remained with him throughout his life. First, he wanted to prove that he, Christophe, was the equal or superior of any man in the world. Next, that black men were inherently equal or superior to their white brethren.

"When the troubles attending the French Revolution broke out in the colony, he became a private in the French Colonial Army. Soon his abilities made him an officer; in a few years a general. Then, when the blacks under Toussaint L'Ouverture rebelled against the French, he commanded the forces of the insurrection in all the northern communes of the colony. After the defeat of the French, he became the second president of the Republic, and eventu-

Photograph by Clifton Adams

CONCH SHELLS AND CHAIRS, CORAL AND DRIED FISH, FOR SALE!

Native bumboats with odd cargoes swarm about when liners reach Port-au-Prince. Passengers toss down coins, for which natives quickly dive should the coin fall into the sea, and purchases are hauled up on a string.

ally mounted the throne as self-crowned king of the North American monarchy."

THROUGH THE MARKET AND ON TO THE CITADEL

As Lake held forth, we rolled past the market place, where drowsy market people were beginning to bestir themselves.

Out across a shaky iron bridge we drove into what had once been the French Royal Highway of the Plaine du Nord, the Haut du Cap, of colonial days. In the French time this had been an avenue wide enough for four carriages to pass abreast. On each side it had been flanked with palatial villas. We could see the crumbling gateposts of many of them, and, back in the shadows, the ruins of *habitations* that once had been.

Here the road was deserted no longer, but as far as the glare of the headlights could penetrate it was thronged with market women and their donkeys, streaming into town with their goods for the morning market. Bare of foot, turbaned, with their long blue gowns fluttering behind them, they swung along, backs rigid, haunches rolling, some chattering and gesticulating, but for the most part silent, weary from their long night on the trail.

Our car nosed east and began to pull uphill. Cocks crowed vociferously, and the scent of dawn was in the air. As we ground along mile after mile, the plain which we traversed constantly mounted higher. From ravines and valleys echoed the thump of drums, never silent in the Haitian mountains, and sprinkled here and there over their almost perpendicular sides shone the red flames of tiny fires.

Gradually earth and air brightened until the sun showed a segment of its red disk over the crest of the jagged mountains on the Dominican border. The nose of our car pointed straight at the Citadel.

Now it was distant and indistinct no longer. Right over our heads it seemed to tower, like a great medieval fortress set on an almost perpendicular mountain peak rising to a tremendous height (see Color Plate I and illustration, page 478). Lake

Photograph by Henry W. Moore

COASTAL TRADING CRAFT MUST COMPETE NOW WITH TRUCKS THAT USE NEW ROADS ALONG THE BEACHES

Anchored on the Port-au-Prince water front at a spot known as the Wharf Cabotage (see Plate IV), these small sailing craft are typical of the fleet that formerly carried all goods and passengers about the island before motor trucks absorbed so much of this trade. On each is a tiny altar and an image of the native water god, Papa Agoué. Sailors blow horns to raise a wind, and sometimes beat Papa Agoué when winds are too strong.

BELOW THE BASTIONS OF AN OLD COLONIAL FORT SPREADS A FINE PANORAMA OF PORT-AU-PRINCE AND ITS ROADSTEAD

Photographs by Clifton Adams

AMERICAN CAPITAL AND ENERGY CREATED THIS 22,000-ACRE SISAL PLANTATION (SEE PAGE 473)

Photograph by Clifton Adams

THE RESORT COLONY OF KENSKOFF LIES IN THE COOLER HILLS ABOVE PORT-AU-PRINCE

Made more easily accessible by good roads built since the American occupation, this hill colony is much sought now both by foreigners and well-to-do native families. Set about 4,600 feet above the city, it enjoys cool breezes and affords a rare view of Port-au-Prince and the sea.

Photograph by Clifton Adams

"HOLD STILL! IT PULLS A LITTLE—BROKEN GLASS ALWAYS DOES!"

When one wants a shave in rural Haiti, all he has to do is break an old bottle, hand a scrap of glass to a bystander and say, "If you please!" Friends usually shave each other. The barber here, using a piece of glass, is not one by trade. In a regular shop in the country areas, a shave costs about one cent.

Photograph by Elizabeth R. Hibbs

WOMEN MAY WALK 50 MILES OR MORE TO MARKET

They enjoy the social wrangle of barter in the market place, where they trade their breadfruit, cassava flour, avocados, and mangoes for a few candles, matches, some salt, calico, or a bit of soap. Walking at night when it is cooler, women may spend several days on a trip, stopping at different markets along the way.

Photograph by Clifton Adams

TRAINING YOUTH IN THIS CENTRAL SCHOOL OF AGRICULTURE, HAITI SEEKS TO AID THE VAST RURAL POPULATION

Connected with the modern institution at Damiens is an experimental station. Boys study animal husbandry, soils, and farm crops adapted to the island. Efforts are made, under American instruction, to improve the culture of cane, cotton, sisal, coffee, fruit, and other crops. Field agents of the United States Department of Agriculture have introduced many vegetables and increased quality and production.

informed me that the peak was known as the Bonnet-à-l'Evêque, the Bishop's Bonnet, and that its altitude was nearly 3,000 feet. The Citadel covered the whole mountain top; there was no room for anything else.*

The enormous size of the structure sank deeply into my imagination. It was roughly square and measured something like 500 feet to a side. Someone once estimated that it contained nearly half a million tons of building material, every pound of which had to be carried up the precipitous side of the mountain more than 2,000 feet above the plain. Ten thousand men were continuously employed.

Lake explained that Christophe built the Citadel as a result of the same driving motives that accounted for a majority of his kingly actions—fear and emulation of the white European powers. He and his little kingdom were free. He resolved that they should remain so, and to that end he decided to build an impregnable fortress to shelter himself and his army should an invader ever attempt to conquer his realm.

He strained every resource of his kingdom and worked his subjects without mercy. The king was a man of huge size and gigantic physical strength, skilled as a mason. Often, tradition says, he would take trowel

* See "A Little-Known Marvel of the Western Hemisphere (Christophe's Citadel)," by Maj. G. H. Osterhout, Jr., in the NATIONAL GEOGRAPHIC MAGAZINE for December, 1920.

Photograph by Albert K. Dawson

THE OLD MARCHÉ EN HAUT, OR "HIGH MARKET," OF PORT-AU-PRINCE IS NOW ABANDONED

Such open squares form market places in all Haitian towns and cities. Wares for sale and barter are laid in little piles, sometimes on straw mats, more often in baskets or on the bare ground. The two most prominent market squares in Port-au-Prince now are the Low Market and Iron Market (see Plate VI), which do business daily. Some wooden houses in the background are built on masonry foundations, remains of French colonial architecture.

and mortar and perform more work in a few hours than the best of his subjects could do in a full day. Always the king drove his workmen. Twenty thousand, it is said, died of hardship and exhaustion, but the king sent his overseers for fresh drafts of peasants and the work continued without pause.

SANS SOUCI, WHERE CHRISTOPHE HELD HIS COURT

Our car crossed a tiny stream and ran through the streets of a squalid native town, Milot. Here had been Sans Souci, the palace where King Henry held his court and where his queen and royal family had their residence. Lake announced that we had finished our journey by automobile and would make the rest of the trip on horseback.

We mounted and trotted off to have a look at Sans Souci before beginning the climb to the Citadel itself. The ruins of the palace and its grounds occupy a pleasant valley about ten acres in extent at the foot of the Bishop's Bonnet. As in the case of the Citadel, the palace was built in emulation of similar structures in Europe of which the king had heard. Christophe, it seemed, had many palaces, all fine.

One day it came to his ears that in Prussia was a much finer palace than any of his, and that it was known as Sans Souci. He resolved to build one of the same name

Photograph by Clifton Adams

CARGOES OF HAITIAN CALABASHES LOOK LIKE TOY BALLOONS

These big gourds, of cannonball size, are borne to market from the hills near Bizoton. The skinny horse walks along the track of the railroad that connects Port-au-Prince with Léogane.

that should be bigger and finer (see illustration, page 477).

He employed women and old men who could not stand the tremendous exertion of carrying building material up to the Citadel. Of these, corvées of 5,000 at a time were used. The building was begun in 1811 and finished the following year.

All of the little valley in which the palace was situated was paved with marble tiles and squares brought from France as ballast in the king's coffee ships. Shrubbery imported from the tropical countries of the world lined its walks and gardens. Cool mountain streams were directed through marble pools and channels.

THE DUKE OF MARMELADE

There were suites within the palace for the ministers of state, for the officers of the palace guard, for the members of the royal family, and for the nobles of the kingdom. A nobility was another of the institutions which the king had created to place his realm on a footing of equality with those of European sovereigns. Among the nobility were the unforgettable Count of Limonade and Duke of Marmelade.

Costly works of art and French mirrors lined the walls of the corridors of the palace, and the Throne Room shone with a magnificence of gold and silver bullion that fairly dazzled all beholders. Appended to the palace was a magnificent royal chapel, a state theater, and barracks for the royal guards; not far away was the arsenal which the king had created for manufacturing and storing powder and shell.

Nearly all of this had vanished in our time. In accounting for the rapid disappearance, local tradition says that the upper stories of the palace and other buildings were of costly wood, and were burned when Sans Souci was sacked after the king's death (see illustration, page 442).

We remounted our horses for the long climb up to the Citadel itself. The trail followed a well-defined zigzag up the side of the precipitous mountain. Once this zigzag had served as the bed of a paved and graded road on which two carriages of state could pass abreast. Vegetation, mountain storms, and a hundred years of neglect had done their work, however. Of the magnificent road, little trace remained except the contour of the grade that had once served as its

Photograph by Clifton Adams

HAITI HAS ITS "HORSEBACK FARMER" WATCHING FIELD HANDS AT WORK

Cotton grows high and is not cut back; much grows wild. This field, being picked, belongs to the experimental farm of Haiti's agricultural school, near Port-au-Prince (see page 462).

bed. Only here and there, where a recent storm had cut deeply into the soft earth, could be seen the huge flagstones and paving blocks of the old Royal Road.

Up a path just wide enough for their feet, our horses toiled and labored. Mile after mile it mounted precipitously into the air. Larger and larger loomed the Citadel.

At last, rounding a final turn, we came under its frowning walls, and after a scramble up a steep slope passed inside through a narrow gateway.

THE CITADEL HOUSED 10,000 TROOPS

Inside the rectangular courtyard, or Place d'Armes, the Citadel seemed more huge than ever. Lake told me that it was begun in 1804 and was still not complete at the king's death, in 1820. The work was carried forward under the supervision of three captive French engineers, one of whom, La Ferrière, gave it the name by which it is often called, "La Citadelle La Ferrière."

Inside the Citadel were an arsenal, storehouses for supplies, and barracks that could accommodate 10,000 troops, as well as a small palace. There were stationed the best trained soldiery of the kingdom. The sides of the hill on which the fortress was built were smoothed away so that they could be commanded in all directions by artillery fire. Batteries of the heaviest cannon of Christophe's day were installed in casemates commanding all approaches. They are still in position to-day (see page 485).

It seems difficult to believe that these huge guns could be dragged to the summit of the Bishop's Bonnet by manpower alone. A typical story of King Henry explains how this was accomplished. Christophe had assigned a hundred men the task of transporting one of these monster cannon up the zigzag roadway in a working day. At noon, while inspecting the work, he noted that they had made little progress.

A delegation waited on the king. "Sire," said their spokesman, "the task you have given us is beyond our strength. We cannot possibly move this heavy cannon the distance you have required of us."

"That is too bad," replied the king. "I am very sorry. What I have to do grieves me immensely, but the king's word is sacred. I have said that you must take this gun to the top of the mountain and I am sure you can do so. If you do not think so, I must

Photograph by Ernest G. Holt

HAITI'S BUSIEST ROAD RUNS FROM PORT-AU-PRINCE TO CAP HAITIEN

First built by the French in colonial times, largely for military use, this 185-mile stretch was improved and modernized after the American occupation. In generations past, millions of blacks have walked its length, which echoes now to the rumble of crowded motorbusses. In all, Haiti enjoys about 1,200 miles of improved highways. The hut at the right is typical of the countryside.

find some way to stimulate you. I think I can find a way."

Saying this, the king ordered his executioners to select 50 of the 100 men and put them to death. The remaining 50 took the cannon to the top of the mountain and placed it in position well ahead of the scheduled time.

SOLDIERS ORDERED TO MARCH OFF CLIFF

On the cleared slopes of the hill the king ordered to be planted yams, bananas, plantains, and other food-producing plants in large quantities, enough to feed the men of his garrison. All of the roofs of the building and its appendages were made watertight and fed a system of cisterns. Providing the usual amount of rain fell, the garrison of the Citadel would never be short of water.

The wall of the castle flanking the space used as a drill ground is a continuation of a sheer cliff. Here the vertical drop is more than 200 feet. Legend says that Christophe,

having heard of the iron discipline of the Prussian soldiers of Frederick the Great, resolved to drill regiments of Haitian soldiers that would outdo those famous grenadiers. When he had trained a regiment to his liking, he would form it facing this 200-foot drop and give the command "Forward March!" If they were properly disciplined, according to the king's idea, the soldiers would march off into space, file after file, until they received the command to halt from the royal lips.

Should any soldiers fail to march off the cliff at his command, Christophe had ways of making them wish they had done so.

HIS MAJESTY'S MOUNTAIN REVELS

Lake led me to the south wall and pointed out some scarcely discernible heaps of crumbling stones several miles distant—the remains of two other palaces, Ramier and Bellevue, respectively. They were small palaces used by the king in his lighter moments. In them were assembled the best wines and liquors, the best cooks at his command, and the most beautiful women of his kingdom. Here he went frequently for extended revels, taking with him the favorite noblemen of the court and occasionally some foreign visitor.

So much has been written and related of the savage, sensational side of Christophe's character that the world is in danger of losing sight of another aspect. He was arbitrary, harsh, and ruthless, of course; but for all that, he was inspired by an ideal, that of building the feeble, ignorant people into a powerful, enlightened state. To attain this end he was willing to make any sacrifice himself or impose any hardship, however savage, upon his people.

Into this task he threw himself with ferocious energy, and the list of his accomplishments reads like a fairy tale. His country must be well armed, powerful. He built the Citadel and other impregnable fortresses. He trained an army which was pronounced the most powerful in the Western Hemisphere. His country must be rich.

He decreed that every one of his subjects must work so many hours a day. He regulated by law just what each must do, and what must be produced. No man must work too long or produce goods likely to leave a surplus on the marts of the kingdom. His was an early parallel of the present-day American idea of planned production.

He instituted a currency that was an example of stability for its day. The unit, a round silver piece about the size of an American dollar, was called the "gourde."

From the earliest days all the countries of the Caribbean, including Haiti, used the Spanish dollar, or *peso*. About the middle of the 16th century the Spanish ran short of silver and so debased their dollars that they were mostly lead, and hence practically valueless. Then vast quantities of silver came from Mexico and Peru, and the Dons reformed their currency. To distinguish the good new dollars from the worthless old ones, the Spanish mints marked each of them with the words "peso—gordo." Gordo is an adjective and means solid, substantial.

In Haiti the natives knew that the new dollars were good dollars, but they did not know what the words stamped on them meant. The Spanish words sounded harsh to their ears; so, in referring to the coins, they frenchified peso—gordo into "piastre-gourde." Later they dropped the piastre from the hyphenated combination, and when the first silver Haitian coins were minted they were inscribed simply as "gourdes," which they have remained ever since.

CHRISTOPHE'S GOLDEN BULLET

Last place of all to which my guide conducted me was a ramshackle lime and plaster structure in the center of the main courtyard of the Citadel. It looked much like a dog-house, but the roof had fallen in and the sides were cracked.

"Christophe's tomb," said Lake.

In 1820, after 14 years of despotic power, Fate overtook King Henry at divine services. Stricken with paralysis, his giant body was cold and dead from the waist down. Revolution broke out. Day by day the paralysis crept upward and the rebels gained ground. At last, realizing the game was up, the crippled monarch caused himself to be attired in his robes of state and placed on his royal throne. There he said farewell to his family and loyal friends.

Then, as the sun was setting, he blew out his brains with a golden bullet he had long carried, believing that it alone had power to cause his death (see page 442).

As we inspected the tomb, a group of peasants approached. "Pilgrims," said Lake.

"If half the stories of how Christophe dealt with his subjects are true," I replied,

Photograph by Clifton Adams

NEAR CROIX DES BOUQUETS A PEASANT BUILT THIS HOUSE OF MUD WALLS AND THATCHED ROOF

In Haiti there is practically no middle class, and this native dwelling is superior to the average countryman's home. Around even the most humble home, however, flowers are often planted.

"I should think they would hate his memory and want to forget him."

"You'd be wrong," my guide replied. "In the north, here, he is regarded as the greatest Haitian who ever lived. He made himself feared and respected by the European powers. He made it possible while he lived for the Haitians to be proud of their country and race. For that they are willing to forgive a great deal."

ASSIGNED TO THE HAITIAN GENDARMERIE

Once again Fate turned up the cards that sent me to Haiti in 1925, this time as an officer in the Gendarmerie d'Haiti, the native constabulary, trained and commanded by U. S. Marines. This was a force of romance. It was made up of black troopers under white officers and was a sort of police unit rather than a real army. I was to hold a commission under the Haitian flag for three years as a member of this force.

I was assigned to command a district on the central plain, with headquarters at the village of Hinche, about 80 miles from Port-au-Prince, in almost the geographic center of Haiti. The district of which it was the capital was about the size of that portion of New Jersey south of Atlantic City, and had a population estimated at a quarter of a million Negroes so black that the darkest resident of Harlem's black belt would be suspected there of being a white man.

Some of the primitive beings there, I was told, had heads shaped like peanuts and shuffled on the sides of their feet in lieu of walking. To police this area I was to have a company of about 200 black troopers, officered by four lieutenants.

Long before dawn I cranked up my small car and set out for Hinche to take over my first command.

In the car beside me was Destiné, my new "Number One Boy" and my first venture in black ivory. Destiné was a wonderful type of tropical servant, the sort who make the White Man's Burden bearable down near the Equator. He was short, slim, jet-black, with a nose like a squashed tomato and lips so thick they gave him the appearance of having a bill like a duck. He did not look quick-witted or intelligent, but appearances in Destiné's case were deceptive. His father had been a Jamaican and he

Photograph by Clifton Adams

SUCH WOODEN HOUSES, FACED WITH FANCY WOODWORK, ARE COMMON IN PORT-AU-PRINCE

Fruit trees grow about the house and a fence guards against stray pigs, chickens, and unwelcome guests; otherwise, country visitors would calmly enter and take a nap under the trees.

could stretch a broad A and drop an H as well as any cockney living, besides reading and writing English and speaking all known varieties of Haitian dialects.

My good angel must have sent Destiné to annex me. He appeared one morning and announced, "I have come, sah, to be your butler, sah." Every *blanc* had a butler, Destiné informed me. I hadn't realized this, but it seemed reasonable, and as Destiné considered the matter settled, I took him on at the princely wage of six dollars a month and found.

CLIMBING STEEP MOUNTAIN GRADES

Our motor hummed along steadily between fields of rustling cane. For 15 miles the road followed easy curves almost at water level toward the mighty central massif of mountain ranges that divides Haiti from the Dominican Republic border to the sea. Then the ascent commenced. In the next mile we must have climbed several hundred feet (see map, page 439).

Now the peaks of the central range, jagged and precipitous, towered almost over our heads, some of them reaching more than 5,000 feet into the air. The wall in front seemed impenetrable. Just as it appeared that we were about to crash into the vertical cliff, a crevice revealed itself and the road oozed to the left down a canyon hitherto invisible, which led out onto the side of the mighty mountain known to the Haitians as Morne à Cabrit, or Goat Mountain.

Up the south face of this mass of rock that rears its head more than 3,500 feet above the plain, the road zigzagged its tortuous way. Two thousand, three thousand feet, we crawled and wriggled back and forth along the precipitous face of the mountain on the road carved like a shelf into the face of the cliff. Everywhere the rock dropped almost perpendicularly from the outside edge of the road hundreds, sometimes thousands, of feet.

At our feet lay the southern plain of Haiti, the Cul de Sac, one of the country's agricultural treasure houses. Thirty miles away across the shimmering flat lay Port-au-Prince, a city of doll houses. Far and near lay habitations, canefields, towns, and villages.

For the last time our car crawled up an almost perpendicular grade to reach the top of the pass, 4,000 feet above the sea.

Then we dropped down over a road that had much the contour of an old-fashioned roller coaster through a maze of valleys and peaks, coming out eventually a dozen miles beyond the high point on the central plateau of Haiti near the old frontier town of Mirebalais.

This central plain, or *savane,* stretches more than 50 miles from north to south and varies from 10 to 30 miles across. In the rainy season it is covered with tall Congo grass, which turns to tinder in the arid months and is swept by searing prairie fires.

By the wells and watercourses the natives lived in wretched clusters of huts, their existence one of poverty and misery. In the winter they were likely to be rained out and in the summer it was more than probable that their poor huts would be destroyed by fire. In the old days they avenged themselves on society by providing savage warriors for the bands of cacos which ravaged the land for so many years, but since the arrival of the American Marines even this consolation has been denied them.

TRAPPED BY A RIVER FLOOD

When our car came down out of the mountains at Mirebalais, Destiné and I thought that the remainder of our journey would prove uneventful. We were wrong. In Haiti the unexpected always happens. A gendarme officer at Mirebalais told us that there was a bad river on our trail, the Peligre. It was one of a total of 42 rivers and streams which we must cross, all of them by fords. It was the rainy season and the rain was due at about 1 o'clock.

We arrived at the river well before 1 o'clock; got nearly across; then our car stuck. Destiné was all upset. The flood was almost due. The sun was shining brightly, and it was difficult for me to believe that a flood was in prospect.

"You don't know these rivers, sah," said Destiné. It was the rain that fell in the mountains, he continued, that produced the floods.

Meantime a couple dozen Haitian peasants had waded into the river and stood around our car: the towing crew, it developed—another custom of the country. These men lived on the banks of the stream near the ford and waited for cars to get stuck. Then they would make big wages pulling the stranded automobiles to the bank and safety. Sometimes each made as much as ten cents gold a week.

The head "boy" of the towing crew was a dignified old citizen with woolly white side whiskers. He bargained with Destiné in a series of sneezes, coughs, and grunts. Bargaining finished, our towing crew hitched a couple of lengths of stout grass rope to the front springs of our car, the boss boy commanded "Allez vite!" and in a jiffy we were high up on the far bank of the stream.

Just in time, too! As I was mopping some of the water off my motor there came a sound like the rumbling of an earthquake. Suddenly, half a mile up the canyon of the stream, a wall of water 10 feet from base to crest burst into view, sweeping down the valley with express-train speed, bearing trees, animals, wreckage of all description in its resistless course. My watch said 1:15. The flood wasn't quite on time, luckily for us. We reached Hinche just before sunset.

My district stretched about 50 miles north and south from Hinche and perhaps 30 miles east and west. There were four good-sized villages besides Hinche itself, but the greater part of its teeming population lived in thatched huts hidden by the high grass, wherever they could find a stream or a spring to afford a water supply.

Enforcing the law was somewhat complicated. The laws were French. They were well enough known in the seacoast towns, but few of the natives of the back districts had ever heard of any law less primitive than that of the club and the knife. Education for them was a minus quantity. In all my district the men and women who could read and write might be counted on the fingers of my two hands.

A LESSON IN POVERTY

The natives' lack of material wealth was almost beyond the comprehension of the inhabitant of a modern, civilized community. To them an empty tin can was a rare treasure and an empty flour sack a rich find. Before I had been long in the district, I had a lesson in their poverty.

One morning in the dry season the fire alarm sounded. A grass-thatched hut in the village blazed and crackled while its owner and his family crouched near by in apathetic grief. Soon the hut was totally consumed.

Next morning among the reports on my desk was one which read: "Fire discovered

10 a. m. yesterday. House of Jean Bonhomme totally destroyed. Loss, $1.25." At first I thought the clerk had misplaced his decimal point, but the report proved correct.

Here is how the figure was arrived at: The cost of the hut was all labor cost, building material being obtainable free from the nearest mud bank or brush thicket. It took about six days' labor to build the house, labor in the Hinche district being priced at 15 cents a day. This brought the total to 90 cents. The remaining 35 cents was made up of furniture, household goods, and personal property.

Sorry for the family's loss, I had the peasant call and presented him with all my loose change, amounting to about $1.50 American. He was overcome by the munificence of the gift and salaamed to the dust. Later, I heard that he bought himself quite a country estate with his new wealth.

Photograph by Clifton Adams

GREEN COFFEE BERRIES ARE SPREAD ON FLAT PANNIERS AND DEFTLY SORTED BY SINGING NATIVES

Trained women and girls work in groups; some sit under sheds, some out in the open, and all do piecework. Often they sing what they call "meringues," which are extemporaneously intoned by a leader. When a stranger stops to watch them work, they immediately begin to sing about him, usually enjoying a laugh at his expense.

One day a local wizard put a *wanga* on me. Wanga is an African word and means a voodoo spell. There are good and bad wangas and wangas to produce all imaginable results. Every white man and every native have wangas put on them from time to time. Natives take them seriously, but whites pay little attention to them. But there are cases on record of misfortunes following in strange series on the trails of those on whom a deadly wanga has been placed.

My wanga was a horse spell. It consisted of a plait of braided horsehair woven in curious fashion around a bit of leather cut from my stirrup strap. Strangely enough, shortly after I noticed the wanga, a horse ran away and my saddle turned over.

The voodoo was one of the outstanding facts in life in the Hinche district. The drums were never silent.

Despite its bizarre aspects, my life in Hinche comprised many pleasant features. When I met the natives on the trail, the men would touch their hats and the women would bow. Then they would say: "Bonjour, Papa Blanc." I always took pains to salute gravely in return and say: "Bonjour, mon fils," or "Bonjour, ma fille," as the case might be.

Photograph by Elizabeth R. Hibbs

LIFE IS JUST A MERRY-GO-ROUND FOR THE BOY ON THE CIRCLING POLE

Whip in one hand, cigarette or banana in the other, he shouts at the plodding ponies, while a primitive mill squeezes the juicy cane. In the background, juice boils to molasses, is skimmed, and boiled again for making brown sugar and rum. Refined sugar can be made only in the larger mills.

Photograph by Clifton Adams

WHO HAS A STRING? OR A ROPE? HOW ENDLESS IS MAN'S QUEST FOR SIMPLE THINGS!

Miles of stout, clean agave fiber, known to the trade as sisal, stripped and hung to dry before shipment from Haiti for manufacture into commercial cordage. In Yucatán, henequin, of the agave family, supplies much of the sisal that is made into twine and used to bind the United States wheat crop (see page 459).

Official photograph, U. S. Navy

LOOKING UP THE COAST OVER CAP HAITIEN, CAPITAL OF THE ISLAND WHEN IT WAS A FRENCH COLONY

Until the French Revolution, Cap Haitien was accounted one of the most prosperous ports in the Western Hemisphere. Here General Leclerc landed with his army, to find yellow fever the chief enemy. To-day, with some 14,000 inhabitants, the city, sanitary and healthful, still trades in sugar, logwood, sisal, and pineapples (see text, page 454).

WHERE CASH IS SCARCE AND LABOR SO CHEAP, WHY BUY RICE MILLS?

Just lift the blunt stick and let it fall into the mortar hewn from a log. That hulls the rice. Winnow it then by shaking the pannier in the breeze, which blows all chaff away. Then pour the clean grain into the old oil can, and threshing is over—a process as old as rice growing.

Photographs by Clifton Adams

NATURE FURNISHES MUCH WILD FOOD, BUT THE HAITIAN MUST WORK TO PROCESS SOME OF IT

This man is grating manioc root to make cassava flour. In the basket are manioc roots, shaped like long, slim sweet potatoes. Besides being used in making bread, the cassava flour is also converted into starch and serves for laundering white clothes.

Then there were my prisoner "house boys," from the local penitentiary. They cleaned up the public grounds and property around my house; also they loved to squat in my back yard and converse, in between begging scraps from Destiné's kitchen. Nobody guarded them; there was no need. Prisoners in Hinche didn't want to run away from jail; they wanted to stay where they were well off. I formed the habit of sitting for a while each day, after lunch, under a big tree to listen to them. They held great councils, mostly, I imagine, for my benefit. Destiné used to stand behind my chair and give me a free translation of what went on.

JAIL POPULAR WITH THE NATIVES

The head "boy" of the group was a white-haired patriarch named Ali. In the pre-American days he was a caco chief. I earned his undying gratitude by keeping him from being put out of jail. Prior to the arrival of the Americans there had been no jail, and when the first penitentiary was opened there was considerable local prejudice against sojourning there.

Later this changed. It was found that the whites didn't do anything terrible to the prisoners. In fact, they did nothing at all except give them three square meals a day and a clean, comfortable straw mat on which to sleep under a rainproof roof. The natives thought all whites were crazy. This was regarded as convincing proof. Soon the peasants became convinced that life in jail was much more comfortable and desirable than freedom, and eventually the penitentiary acquired a waiting list.

The trouble with Ali was that his sentence had expired. He didn't understand this. The gap between his comprehension and my ability to explain was so wide that I never succeeded in making it clear to him. He only knew that in the beginning he hadn't wanted to go to jail, but the gendarmes had brought him there by force.

Now that he was really beginning to like the place, they wanted to throw him out. I fixed the matter up by getting his sentence extended as a special favor.

One day word came to me that the period of my tour of duty at Hinche had expired, and I was summoned to Port-au-Prince for service in the metropolis.

The capital had undergone many changes since my first visit. More than a dozen years had elapsed, and the American Marines had been in control for ten of them. There had been no revolutions, no riots, no fires of any consequence. U. S. Navy doctors had effected startling changes in the health of the city. Epidemic diseases had been stamped out. A germ-free water supply had been provided. It was said that even malaria, the ever-present scourge of the Tropics, had been banished from the city limits.

American Navy engineers had remodeled the city. Public parks had been cleaned up and beautified. An elaborate program of public works had studded the streets of the official section of the town with gleaming white public buildings. Swamps had been drained and filled in, sewage disposed of in a sanitary manner.

Taking advantage of the new security to provide residences for the officers of the Occupation and those of the Marine Brigade, local capitalists had engineered a building boom. The fashionable residence sections of Bois Verna and Turgeau, on the hills above the lower town, had multiplied in extent.

It was computed that the Occupation brought more than a million American dollars to be spent in Haiti each year, and a large portion of it found its way into the pockets of landlords and tradesmen of the capital city. The city showed the effect of this stream of alien gold. It was a tropical Spotless Town.

In due time I arrived in Port-au-Prince and found a home, a lovely villa outside the business section of the city, in the hills to the south. It had been the seat of a French colonial family and was still known to the natives by their name, as the Habitation Martissant.

The house was a two-story wooden structure, raised on the foundations of the old colonial mansion. Its wide-spreading veranda overlooked the bay of Port-au-Prince from an altitude of some 600 feet, while its rear backed up against towering mountains which rose steeply almost from the garden wall.

In the daytime brisk sea breezes fanned its front, and at night cold air from the mountains rushed through its chambers and bedrooms, making a blanket necessary even in the hottest season.

From my front doorstep an avenue of gorgeous royal palms ran down a steep grade to the Bizoton Road, a quarter of a mile below. Oranges bloomed in the garden, mangoes came and went with the summer season, avocados flourished in profusion.

Photograph by Capt. Albert W. Stevens

LOFTY RUINS OF SANS SOUCI PALACE ATTEST THE VAULTING AMBITION OF AUDACIOUS CHRISTOPHE

Fantastic in his dreams of empire, the monarch amazed the world when at the zenith of his power he erected this architectural marvel high up in Haiti's mountain wilderness. Here he held his glittering court and other royal ceremonies in the large palace (left center). Circular ruins in the lower left corner are remains of the king's private theater. In the center area, "where once the garden smiled, still many a garden flower grows wild" (see text, page 463).

The hibiscus, poinsettia, and bougainvillea spread their luxuriance. A Haitian friend and I once counted more than 70 different varieties of tropical fruits, shrubs, and flowers. The Martissant family had been noted for their love of plants, and these were what remained of the paradise they had created here before the slave revolution.

It was pleasant to sit on the veranda in the afternoon, when the setting sun hung round and red over blue Gonâve Island, in the distance, and the city, like a map, lay unrolled at one's feet (see page 459).

A HAITIAN INAUGURAL, NEW STYLE

The town began at the edge of the sparkling waters of the bay. From above, it appeared somewhat the shape of a thick crescent moon with the concave side toward the sea. About the middle of the crescent the wharf jutted out like a thick cigar from the mouth of a man in the moon.

My first job in Port-au-Prince was to command the Caserne Dartiguenave, the barracks where was quartered the military garrison of the city. I had under my command about 300 gendarmes, organized into three companies. There was also a force of U. S. Marines stationed in the city, but it was not the policy to employ these in police work, and in my time their aid was never necessary.

An election was approaching. In the old days each election had been accompanied by a reign of terror. In my time no trouble was expected, but every provision was made

Photograph by Capt. Albert W. Stevens

HIGH ON THE RANGE (IN THE UPPER CENTER BACKGROUND) STANDS THE HISTORIC CITADEL OF CHRISTOPHE

With its thick walls, gun chambers, parapets, and dungeons, this giant isolated fortress is one of the most remarkable ruins in the Western World. It was built by the ex-slave waiter, Christophe, a Negro who was crowned king and diplomatically recognized by Europe. The vast structure is deserted now (see text, page 456, and Plates I and V).

Photograph by Clifton Adams

TOOTING AND THUMPING ON CRUDE INSTRUMENTS OF JUNGLE ORIGIN

Only native "music"—no tunes as we know them—is played on these bamboo horns. Drums of "voodoo" type are held between the knees and played by being beaten and rubbed with the hands. Before the girl on the right a male dancer will presently appear, holding a coin in his mouth. Unless he can give a satisfactory imitation of her dance, she takes the coin.

Photograph by Clifton Adams

SALT SCRAPED UP IN PILES WHERE SEA WATER HAS BEEN EVAPORATED

These ponds, at the mouth of the Artibonite River, and those near Fort Liberté and elsewhere, supply common salt to the people. Burros and boats carry it away in sacks and baskets.

to render disturbance impossible. Training schedules were prepared, all leave was canceled, and officers worked day and night to bring their commands to the highest possible state of proficiency. The election came and went with virtually no disorder.

About a month after the voting came the inauguration ceremonies. The world was treated to the spectacle of a Haitian president taking his seat in peace, at the legally appointed time, as the result of an election conducted in accordance with the laws of his country. This was in May, 1926. The like had happened only once before in history, in 1922, when Mr. Louis Borno succeeded Mr. Sudre Dartiguenave, first president under the American Occupation.

TAKING THE ARMY TO CHURCH

Both the incoming and the outgoing president were present on that occasion and both were alive and reasonably happy. Now Mr. Borno was succeeding himself legally and in peace, after a full and peaceful constitutional term.

My part in the ceremonies was not exciting, but interesting. I took the Army to church for the service held in honor of the occasion. This was a survival of an old custom. In former days Haitian presidents always took the army to church. When the ruler was at his devotions was a favorite time for adversaries to start a revolution. So it became the custom to keep the Army handy. Any president who failed to do so was likely to find that he was no longer president when he emerged from the doors of the sacred edifice.

Our battalion formed at the barracks and, headed by its flags and the palace band, marched to the Cathedral. This huge white structure, one of the most imposing buildings in the West Indies, faces toward the bay, and across its front is a wide concrete driveway from which half a dozen steps lead to a stately portico before the main entrance. Directly in front stands the famous Iron Market (see Color Plate VI) and around it is the heart of old Port-au-Prince.

We lined up our battalion of khaki-clad gendarmes facing the Cathedral. In their center were the National Colors with their color guard, and to the right the band, ready to render musical honors to the President and to visiting dignitaries.

Photograph by Clifton Adams

BAKING CASSAVA CAKES ON A PIECE OF SHEET IRON AT PÉTIONVILLE

First a manioc root is grated and all poison washed and squeezed out. Then the fine white flour is made into pancakes. Cassava forms a staple item in Haiti's diet.

Ornate equipages drove up. Dignitaries descended from them and made their way up the steps of the Cathedral. Other throngs of spectators arrived on foot. Droves of school children came, their stiffly starched white robes contrasting with their excited dusky faces. A troop of Haitian Boy Scouts arrived in khaki shorts.

The Cathedral began to fill up and the throngs, awaiting the arrival of the President, began to press against the ropes that separated the driveway from the spaces marked off for the public. At last came a rattle and a clatter of hoofs and a dozen aides-de-camp cantered up on horseback, escorting the presidential automobile.

Troopers took the horses and the aides climbed the steps to attend their chief. The car halted and the President descended. With measured tread he mounted the stone steps, faced about, and removed his hat. At the signal, the colors of my gendarme battalion, now directly in front of him, were raised in salute and the battalion presented arms. The band struck up the presidential march, followed immediately by the Haitian national anthem, "The Dessalinien."

As the last bar of the music died away came the deep boom of the first gun of a national salute. It was a striking ceremony.

As I stood rigidly, with my gleaming saber held at attention, I could not help thinking of other days. Now my dependable, American-trained battalion stood stolidly in immaculate lines, admired by well-dressed, prosperous-looking citizens, while the Chief of State safely went about his devotions.

Had anyone suggested to the participants that the soldiers might soon assassinate the President or begin to massacre the spectators, he would have been thought insane. It was different in the old days.

At the Fête Dieu, for example, May 28, 1891, when President Hippolyte was in church, a revolution broke out. Troops mutinied, and there was a bloody battle. But the President got the upper hand, and for hours led his regiments through the streets, shooting all he chanced to meet. A little park near the Palace was stacked with corpses piled like cordwood. I wondered if savage old Hippolyte could see us and note the changes time had wrought.

Then we took our troops home for lunch. Other festivities were scheduled for the afternoon.

GAYETY AT THE PALACE

The Presidential Palace stirred with animation, for this was a great day on its calendar. Its white bulk, silhouetted against the heaven-climbing mountains, made a lovely picture. Like most things in Port-au-Prince, the Palace is a copy of something French, the Petit Palais of the Champs Elysées being its model. It is one of the most impressive buildings in the West Indies, yet one is never able to repress a start at its Franco-Greek façade cast against palm-sprinkled hills, on which drums beat in perpetual staccato (see page 437).

Gay streamers of bunting decorated the front of the building. On a balcony the President and his Cabinet, with their ladies, were assembled. Other balconies and windows were crowded with guests.

A battalion of gendarmes, with their American officers, led by their band and colors, passed in formal review to do honor to the Chief of State and the Haitian flag, which flew at its masthead over his head.

On the Palace steps were gathered the officers of the President's Guard and his aides-de-camp in white uniforms. In former years these had been generals, some of the 1,200 of that rank in the country's army. Now, under sober American auspices, they were lieutenants, with a captain or two.

When the review was finished, the reception commenced.

In a spacious salon at the head of a marble staircase, President Borno stood to receive his guests. Sweeping windows opening on ample balconies dotted the walls of the chamber, admitting every vagrant breath of tropic air. Tapestries and hangings lent dignity and grace, and along the walls on every hand tables groaned with sandwiches, cakes, sweetmeats, and beverages for the refreshment of the hungry, thirsty, or convivial.

In a corner the champagne of France bubbled and sparkled. At an imitation American bar a white-coated and white-aproned servitor compounded cocktails. Another table was devoted to the rums of the country, famous since the days of the French colony. Here were no ordinary rums, but the celebrated beverages of Aux Cayes, Jérémie, and Anse-à-Veau. One, served in thimblelike glasses, was the famed Presidential Rum, said to be over 100 years old.

Slowly the guests arrived, filling the spacious chamber. Here were blond Americans in spotless white uniforms with gleaming gold buttons and ornaments. Here were phlegmatic Englishmen, excitable Frenchmen, traders of every nationality. Here were Haitian statesmen and diplomats of every shade and coloring, in frock coats, many of them with ribbons of the orders of many courts of Europe gleaming on their shirt fronts.

BEAUTIES OF EVERY TYPE AND COLOR

There were beautiful women, blond and golden, copper and ebony mingled together, clothed in the latest creations of Worth and Paquin, with masterpieces of jewelry from the shops of the Rue de la Paix gleaming on their persons. Here fair foreign women from the snows of the North mingled with the lively *filles de couleur* of the Indies, famed for beauty from time out of mind. Here griffe (black, with a small amount of white blood), quarteronne (quadroon), and métisse mingled with mulâtresse and maraboute. Forms tall, erect, graceful; hands and feet long and shapely; faces about which a sculptor might dream.

A stately man in his middle fifties, Mr. Borno stood in the receiving line to welcome his guests. About middle height, with the face of a student, aquiline nose, and gray-brown eyes, he looked every inch a potentate, and might easily have been mistaken for an Italian or a native of the south of France. A celebrated international lawyer and an able statesman, Mr. Borno was an admirer of Mussolini and endeavored to adapt the Duce's doctrines, so far as was possible, to the needs of the Haitian State. This had advantages and defects. However that may be, he labored earnestly for the advancement of his country.

THE HAITIAN "NIGHT STICK"

As time went on, I was made Chief of Police of Port-au-Prince. Under my command were more than 200 gendarmes, selected for their intelligence and good records. Their duty was to maintain patrol systems and supervision within the city, much in the manner of police forces the world over. My policemen, being regularly enlisted gendarmes, had rifles and bayonets, but they did not carry them, except occasionally on parade. For police duty they

IN HAITI HE LAUGHS LAST WHOSE FIGHTING COCK WINS THE MONEY

Photographs by Clifton Adams

"I BET TEN GOURDES MY RED ONE WHIPS YOUR BLACK ONE!"

No metal spurs are used here. Native rooster-fighting fans file the cock's spurs sharp. Fowls that fall in battle are taken home and cooked. This Sunday morning cockpit scene was near the town of Thor.

went equipped with revolvers and *coco-macaques*.

The cocomacaque was a peculiarly Haitian institution. I met it when inspecting my first squad of policemen. The corporal carried what looked like an exaggerated walking stick. I examined it with respect. It seemed a fearful bludgeon, perhaps three feet long by two inches in diameter. Polished with oil until it took on the shine and color of ripe bananas, it was a beautiful thing. The wood seemed as hard as iron and was encircled by a succession of concentric rings, with a thick knot at the business end.

These clubs served the purpose of night sticks in American communities. I learned that the word meant "monkey coconut tree," and that the sticks were made from a species of dwarf coconut palm bearing coconuts the size of almonds.

The cocomacaque occupies a classic position in Haitian annals. Following the uprising of the slaves and the attainment of independence, it became unlawful to beat any Haitian with a whip or club, these being reminiscent of slavery.

But the new chiefs of the Haitian State felt it necessary to have something with which to inflict corporal punishment on their subjects; so Dessalines, the first emperor-president, discovered the cocomacaque. This, he decided, would inflict the maximum physical punishment with the minimum of indignity to the spirit of the new freemen.

THE AMERICAN OCCUPATION OF HAITI

As Chief of Police of Haiti's capital, I acquired functions in a number of fields of civil government and came much in contact with the remarkable organization which the United States had created under the designation of the American Occupation. The United States was endeavoring to do in Haiti something entirely new in the annals of the world. Other nations had annexed colonies, but here was a powerful nation occupying the territory of a small country by military force for the sole purpose of bringing to the weaker nation civilization and order, blessings which, in reality, Haiti would have been entirely content to get along without.

No precedents existed and the United States had evolved an organization by a series of steps as necessity arose. In the beginning there were errors; misunderstandings abounded on both sides. American authority was hopelessly divided among a number of coequal officials.

Matters came to a head after the so-called Caco Rebellion of 1919-20. A reorganization was imperative. Experts, including Dr. Carl Kelsey, of the University of Pennsylvania, visited Haiti. Brig. Gen. George Richards, Paymaster of the Marine Corps, at the instance of the United States State Department, made a study of the situation. A commission from the United States Senate conducted hearings in Port-au-Prince. As a result of recommendations, the machinery of the American Occupation was redesigned, with a High Commissioner, appointed by the President of the United States, as its supreme head. From his decision there was no appeal.

The first American High Commissioner was John H. Russell, then Brigadier General, now Commandant, of the Marine Corps. In addition to his military position he had the rank of Envoy Extraordinary and Minister Plenipotentiary. With this new organization under a unified control, a new phase of the march of Haiti toward modernity and civilization began. It is impossible to give to General Russell too much credit for his share in the work that followed. Under his administration, for the first time Haiti was given the benefit of intelligent, long-time planning in the development of her national affairs, and a government which could formulate progressive policies and execute them with untiring efficiency and rigorous probity.

Under General Russell were American treaty officials having to do with different departments of the public administration—Finance, Public Order, Public Works, Public Health, and the like. They remade the Haitian State from its foundations upward.

The Department of Finance in particular accomplished results far and away beyond what had been expected or hoped. Plunging into the obscure mazes of pre-American finances, the Yankee accountants ascertained for the first time in history just how much the Haitian Government owed, both to foreign creditors and to her own citizens.

Much of the Haitian debt was held in France. When the franc was at nearly its lowest ebb, the debt was refinanced with a loan from the United States, thus at a

Photograph by Clifton Adams

IDLE FOR A HUNDRED YEARS, THESE BIG GUNS TELL AN ELOQUENT STORY

They were dragged through steaming jungles and up steep, back-breaking slopes to Christophe's pretentious citadel. The toil of thousands who labored on the fort recalls that of other sweating hordes who were ruthlessly driven to build Egypt's Pyramids. On the chamber walls and on the cannons are inscriptions of French, Spanish, and English origin (see page 465 and Plate I).

stroke cutting nearly four-fifths from the indebtedness of the Nation. Modern revenue laws were designed. From being chronically bankrupt, the Haitian treasury showed a large surplus each year, despite heavy appropriations for public works.

Even to-day, after five years of depression, the Haitian Government is able to run on current income and has a credit balance in its treasury.

THE DAWN OF A NEW ERA

United States forces were to be withdrawn in October, 1934, and the administration of the Haitian Republic returned to native hands. Actually, the withdrawal has already taken place, many weeks in advance of the time set.

American forces first landed in Port-au-Prince in July, 1915. At the time of the withdrawal they had occupied the country for a trifle more than 19 years.

During that period their accomplishments in behalf of civilization and progress were little short of marvelous. They found the land in the Stone Age. They left it remarkably well abreast of the middle twentieth century.

The opinions or assertions contained in this article are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

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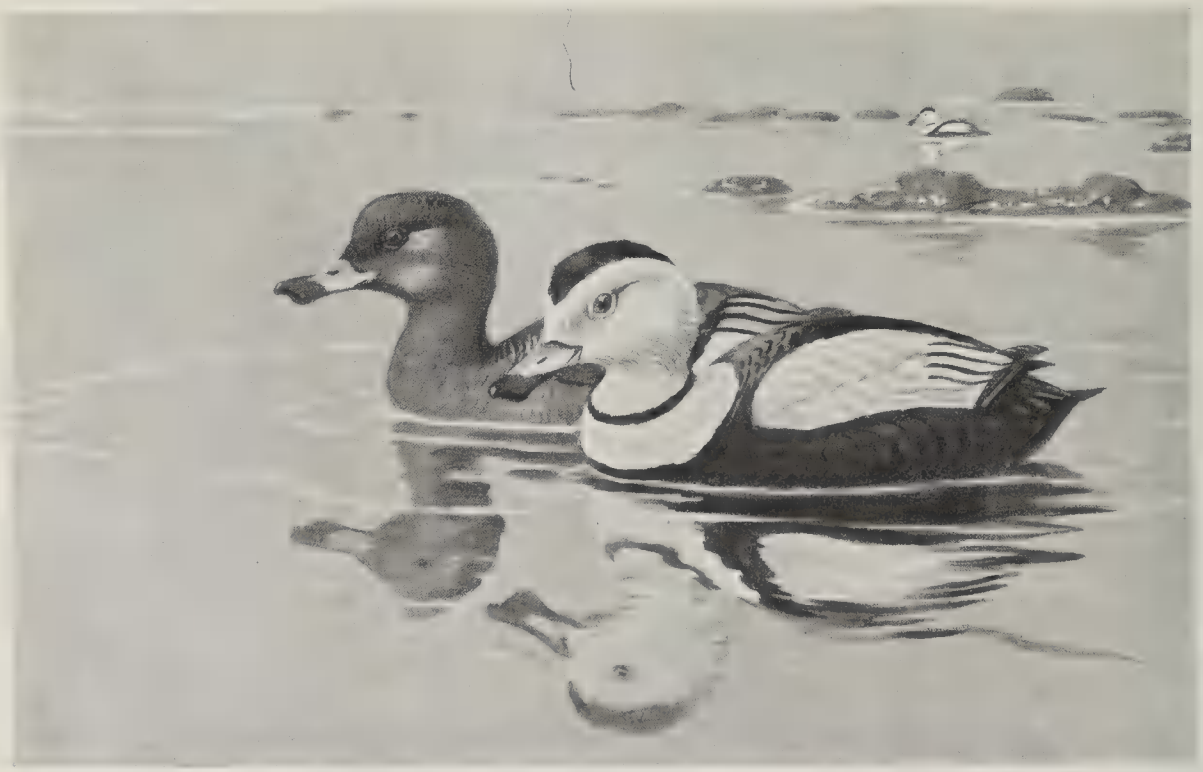
Photograph by George Shiras, 3d

"DARK FLYING RUNE AGAINST THE WESTERN GLOW—"

By a strange, instinctive dead reckoning which has no need of map or compass, old ganders lead the long converging lines of the migrating "honkers," or Canada geese, here speeding over Michigan (see Color Plate II).



Drawing by Maj. Allan Brooks

WHY DID THEY VANISH FROM THE EARTH?

Mystery surrounds the extinction of the Labrador duck; the last one on record was killed near Long Island, New York, nearly 60 years ago (see text, page 491). To-day a few of the mild-looking little fellows may be seen—but stuffed and in museums.

FAR-FLYING WILD FOWL AND THEIR FOES*

By Major Allan Brooks

With Paintings from Life by the Author

"Dark flying rune against the western glow—
It tells the sweep and loneliness of things."

SO WROTE Pai Ta-shun (an American and not a Chinese) in the finest of all poems on wild fowl, and many others have drawn inspiration from the striking formations that especially characterize the movements of swans, geese, and ducks.

That flying wedge or undulating line etched against the sunset sky or the orderly, swift-moving formation high overhead! Here is the symbol that inspires the imagination of even the casual observer, as it has the poets who have written of flying wild fowl through the ages.

Behind this aura of glamour and mystery lies the fascinating life story of the majestic wild swans, the wily geese, the hardy and adaptable ducks, and the fish-loving mergansers, which, all together, form the suborder Anseres. They are a fairly compact and homogeneous group of birds, their only relatives of undoubted connection being the screamers of South America, large, goose-like, wading birds with unwebbed toes.

Geese and ducks are found all over the world wherever water exists, except on the oceans far from land.

Common to the order are a long neck, sometimes very long; short legs, webbed toes, and a bill covered with sensitive skin and provided inside with comblike structures known as *lamellae,* modified in the mergansers to sharp "teeth" for holding slippery fish.

The eggs are without markings, and the young, hatched covered with down, are able to find their own food very soon after they emerge from the egg.

The graceful, snow-white swans, sometimes five feet in length, make up the first of seven subfamilies into which are divided the North American members of the suborder. The other six are the geese, tree ducks, surface-feeding ducks, diving ducks, stiff-tailed ducks, and mergansers.

Much that has been written about swans has been influenced by their æsthetic appeal. This is apt to distort the facts to their advantage, and it is just as well, because no other birds can provide the thrill that a flock of wild swans gives the nature lover.

First in order and in size, they have a form too universally known to require description (see Plate I). The two North American species are so similar that they can be differentiated with certainty only by the character of their internal structure and by their very distinct voices.

SWANS ARE MODELS OF BEAUTY AND FIDELITY

Swans are perfect models of conjugal conduct. They mate for life and the sexes share the domestic responsibilities.

The downy young when first hatched are not the "ugly ducklings" of popular belief, but lovely little creatures, clothed in silky, golden down and without the exaggerated neck and huge paddlelike feet of their parents. Very soon, however, these characteristics begin to appear and ungainliness replaces their natal loveliness until the grace and beauty of maturity appear.

Fortunately, there is small if any possibility of the extermination of the whistling swan, and with careful conservation it may even be possible to perpetuate the trumpeter.

The goose family is well represented in North America, especially in the West, where in some localities six species may be seen on the same ground.

Their extraordinary migrations and the mystery of their breeding grounds intensify the interest that both sportsmen and naturalists take in these fine birds. Even yet, there are a few whose summer homes are unknown, while the systematic status of some of the races and their relation to each other have still to be worked out. Much study in the field, especially at their nesting grounds, is required to establish these facts.

Geese, like swans, pair for life, and the young birds remain in the company of their parents for nearly a year after they are hatched.

* This is the ninth article, illustrated by paintings by Maj. Allan Brooks, in the important Geographic series describing the bird families of the United States and Canada. A tenth article, with paintings in color by Major Brooks, will appear in an early number.

© George S. Wilcox

"DUCK HEAVEN" ON AN ARKANSAS ESTATE

Many thousands of ducks gather annually under the care and protection of George S. Wilcox on his property in the White River bottoms of Arkansas County, near Stuttgart. They are mostly mallards, with a sprinkling of pintails and green-winged teal (see Color Plates V and VII and illustration, page 491). The region is one of the foremost concentration areas for mallards in the world.

Endowed with keen intelligence and extreme wariness, they can be depended on to maintain a fair degree of abundance as long as adequate wintering grounds are afforded them. But, above all, they, like swans, require freedom from molestation when they are at rest, so that a large measure of solitude and wide spaces are the chief requirements for their perpetuation.

Both families have a lower rate of reproduction than ducks, as they require several years to attain maturity and the number of eggs laid is much smaller than with most species of ducks.

Whether by day or night, geese do a lot of calling while in flight; when migrating high overhead the clamor of their voices falling from the sky draws attention to the flock in arrowhead formation, cleaving the upper air (see illustration, page 486). Species can be identified by their different voices. When feeding they are silent, only gabbling a little to each other in low tones. The first appearance of danger will bring a warning challenge from the sentinel and every head is erected while the danger is scrutinized (see Color Plate II).

Both geese and swans are noted for their longevity, the latter being among the Methuselahs of the bird world.

There is actual record of a mute swan that lived 70 years, while rather uncertain report has attributed even a greater age to the birds.

Somewhat intermediate between ducks and geese are the tree ducks (see Plate XVI). They have only two representatives north of the Mexico-United States boundary, and neither of these penetrates much to the north of this line. Their name is misleading in our own territory, as here we seldom see them perching in trees and their nests are on the ground.

The great group of ducks is divided into two main sections, the surface-feeding and diving ducks. While these names actually

afford a general basis of distinction, it does not follow that surface-feeders never dive for their food, nor that diving ducks never feed on the surface.

To separate the groups, look at the foot. In the diving ducks, the hind toe has a lobe, so that it resembles a little paddle. In the surface-feeding group it is not particularly specialized (see illustration, p. 490).

If sportsmen wish to identify the ducks they shoot in all plumages, it is essential that they recognize the distinction between the two groups.

THE "HIND-TOE" FORMULA

By the "hind-toe" formula, stiff-tailed ducks fall under the category of diving ducks, but in many features of structure, plumage, and life characters they are further removed from true ducks than are the mergansers. The sometimes pugnacious and somewhat ludicrous-appearing ruddy duck is the sole representative of the stiff-tailed ducks in the United States and Canada, although a South American species, the masked duck, has been twice recorded in the Eastern States as a straggler.

Mergansers, the last of the duck group, are ducks with a narrow, specialized bill, edged with saw teeth, which enable them to catch and devour good-sized fish. Their feet, though proportionately smaller, resemble those of the diving ducks in having a paddle-shaped hind toe.

Ducks, for the most part, are very different from swans and geese in their family habits. While they pair much like other birds and are not as a rule polygamous or polyandrous, the male in most species is not a constant husband, and abandons the female and all family cares as soon as incubation of the eggs is well under way. Stiff-tailed ducks are notable exceptions to this rule, and in some true ducks, like the eiders, the male is not altogether indifferent to his family obligations.

Few ducks have striking voices. They are entirely different in the sexes, that of the male being often more musical than the female's, which varies from a quack to a croak in most of the species. Only one or two species may be called loquacious, the most notable being the old-squaw, which derives this name and many others from the syllabication of the musical call of the males, whose morning concert is one of the cheeriest sounds of the seashore.

The sexual difference in the voices has its origin in the very different patterns in the formation of the trachea. In some species this organ has a curious and elaborate sound box formed by an abrupt enlargement above the bronchial tubes in the male. There is a large variation of this character in different species.

The plumage of ducks is notable in the peculiar formation of some of their characteristic markings; many of these are repeated in several species, often in widely different genera. The white mark in front of the eye of the blue-winged teal is repeated in the harlequin and both species of golden-eyes (see Plates VIII and XI).

The transverse bands of black and white on the sides of the breast may be seen in the wood duck, green-winged teal, hooded merganser, and male harlequin (see Plates VII, XI, XV, and XVI). Indeed, the harlequin may be said to possess all the bizarre markings peculiar to the duck tribe on his own small body, including the white spot between the thighs and the base of the tail, which is found in one form or another in so many species.

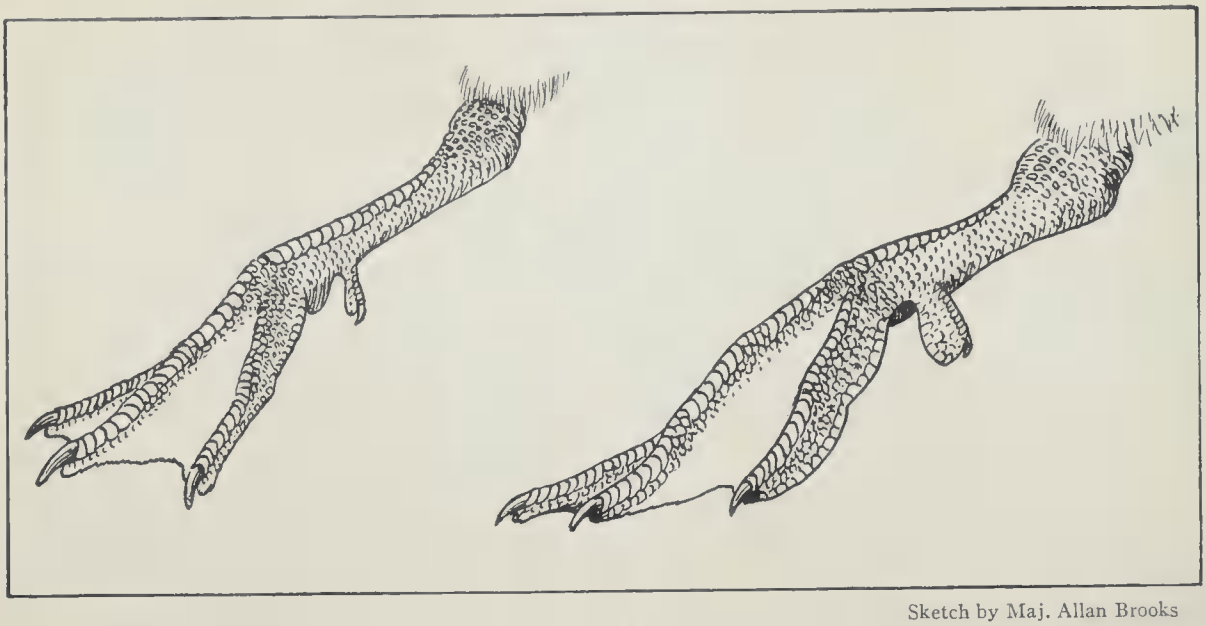
A feature of these adornments is that the white feathers composing them are specialized, usually of a texture different from the surrounding plumage.

THE DUCK'S "BEAUTY SPOT"

The speculum, or beauty spot, formed by the iridescent color of the secondary feathers of the wing, is a conspicuous feature of most surface-feeding ducks, although absent from nearly all the diving ducks, except the eiders and the male harlequin, and here again the harlequin shows up!

Towards midsummer the bright plumage of the drakes is gradually shed and replaced for two months or longer by a more somber feathering resembling that of the females. This phenomenon, known as the "eclipse," in the fullest expression is peculiar to the ducks, and is generally regarded as being a measure of protection while the bird is shedding his flight feathers. While thus rendered flightless, the accompanying dull-colored plumage will enable him to hide from his enemies more easily as he skulks in the rushes.

But this theory falls down when it is realized that only in the ducks of the Northern Hemisphere does this eclipse occur. In



Sketch by Maj. Allan Brooks

BY THEIR FEET YOU MAY KNOW THEM

The badge of membership in the group of diving ducks is the lobe, like a little paddle, on the hind toe, as shown in the drawing of a redhead's foot at the right. The unlobed hind toe on the mallard's foot at the left distinguishes the surface-feeding ducks. With the aid of the "paddle," some of the diving ducks reach considerable depths and have been caught in fishermen's nets from 80 to 100 feet below the surface.

the Southern, even when climatic conditions are similar to those in the far north, no eclipse occurs in any species. The extreme example of this is the cinnamon teal, whose range is divided into a northern and southern "colony," one in North and one in South America.

In the northern, a regular eclipse occurs when the male assumes a dress somewhat similar to the female's for several months. In the southern colony, extending south to Patagonia, no change takes place, and the male has only one molt in the year instead of two.

Strangest of all, ducks from the Southern Hemisphere when brought in captivity to our northern zoos do, in some species, after the lapse of a few years, commence to evolve an eclipse similar to that of their northern brethren.

This I have witnessed myself in the case of the Australian red-breasted teal kept in the zoölogical gardens in London.

In some northern ducks there is little or no eclipse. It is absent in all the scoters and only slightly in evidence in the canvas-back, while in the case of the old-squaw the eclipse takes place in May prior to the northward migration, and this summer plumage is almost as handsome as the winter dress (see Color Plate XII).

The ruddy duck (see Color Plate X) is distinguished from all our other ducks by possessing an ordinary sequence of spring and winter plumages similar to the plovers and sandpipers and so many small birds.

As the subfamily to which the ruddy belongs, that of the stiff-tailed ducks, is regarded as a "primitive" type, it is possible that the eclipse is evolved from a similar condition. In other words, the eclipse may be only a modification of the ordinary fall or winter dress.

A strange phenomenon of the eclipse is the thoroughness of the imitation of the female aspect in most species. Gadwalls and shovellers not only acquire a female plumage but their black bills change to the olive and orange color of the females, while the male of the American merganser, a crestless bird in full plumage, not only acquires the duller colors of the female but also the long crest of reddish feathers (see Color Plate XV).

The character of the eclipse has been dealt with at some length. Comparatively few people are aware of its existence, even though the drakes of our barnyard go through it each year; also, the consequences of its action have a direct bearing. The wood duck is protected over nearly the whole of America, and the striking plumage of the male is fairly well known; yet in the open duck-shooting season, starting in September in many Provinces of Canada, no trace of the well-known plumage of the male

exists, all males resembling the dull-colored female (see Color Plate XVI).

A great divergence in the arrival of maturity exists in the duck tribe. Swans are not fully mature before their fourth year; most geese probably nest in their third year, while ducks of most species usually pair and nest in the spring following their hatching, or before they are a year old. This has a direct influence on the rate of reproduction in each species and should be taken into consideration.

All the surface-feeding ducks nest before they are one year old, although this may not be universal in the case of some species such as the pintail and the widgeon.

A similar condition exists in most diving ducks, but notable exceptions are goldeneyes, buffleheads, harlequins, and old-squaws, in which the males do not acquire full plumage until they are nearly two years old. In the eiders and scoters the adult stage is still further delayed.

Mention should be made of the extinct Labrador duck, *Camptorhynchus labradorius,* the last verified record of which was a bird taken in 1875 (see page 486).

The passing of this species is a mystery which cannot be accounted for; even from the earliest days for which we have any record of the bird, it was a scarce species in the limited area of its range on the North Atlantic coast.

Frequenting the shoal water of the shallow bays, it could not have been in much demand for food and few were brought in to the markets. There is no record of its nesting, nor even, with any certainty, of its summer home. Although it was a diving duck, the peculiar shape of its bill suggests that it sifted its food in shallow water.

PROBLEMS OF CONSERVATION

Of all the questions relating to wild fowl, the problem of their perpetuation is the most important. Every one naturally takes an interest in their conservation and wishes to see an increase in their numbers. But unfortunately there are two divergent schools at work, one that wishes to protect wild fowl from the viewpoint that they provide sport, and the opposite group that insists they be protected vigorously and all shooting be abolished. Between the two extremes lie all shades of compromise.

For the good of the wild fowl of North America, it is essential that these different views be reconciled, and a concerted course

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WATCHING OVER HIS WILD-DUCK GUESTS

From the platform in the top of this bitter pecan tree, nearly 100 feet from the ground, George S. Wilcox, shown here on his way up, studies the flight habits of ducks flocking to his sanctuary near Stuttgart, Arkansas (see page 488).

of action that has the support of all parties is unquestionably the goal for which we must strive.

There can be no question that the total abolishment of their pursuit for sport can never be achieved. Equally certain is it that the old days of huge bags and reckless killing are gone forever. Taken as a whole, modern sportsmen are exceedingly tolerant and are obviously eager to support any sound schemes for protection.

While the dire prophecies of the total extermination of the ducks and geese of North America are obviously the product of a distorted outlook, yet action is required to cope with many of the dangers to which they are now subjected.

The basic requirement is a realization of the immense difference in conditions in the West as compared to the East. What must strike the most casual observer familiar with eastern conditions is the fact that in the West almost every puddle of water has ducks on it, and the drier the region the more certain it is that small ponds will be inhabited. Conversely, the westerner on a visit to almost any region in the East is struck by the large areas of untenanted duck marshes and lakes.

Probably the basis of this is the fact that the whole of the West is a nesting region for ducks and, to a less extent, geese.

Draw a line from the mouth of the Mississippi River due north to the Coronation Gulf on the Arctic coast. Nine tenths of the ducks of North America breed to the west of this line, although many of them may winter entirely to the east of it. This fact should be the basis for all protective work.

THE ENEMIES OF DUCKS AND GEESE

While duck shooting is one of the causes for our failing duck supply, it must not be considered to constitute the major cause for remedial action. Duck shooters must realize that the restrictions for smaller bag limits and in the firearms allowed must be made permanent, but it is equally important that the conservationist who wishes to curtail their sport must recognize the value in certain cases of some of the practices he may most strenuously oppose.

The chief enemies of our ducks and geese may be classified under the following heads:

Shooting; predators and natural enemies; parasitic diseases; failure of water supply; duck disease (botulism); destruction by crude oil, chemicals, lead poisoning; destruction on their nesting grounds by climatic conditions.

Of these, shooting in all its forms and abuses has been exhaustively dealt with, and this has a tendency to minimize the danger incurred from the other factors.

Predators and natural enemies include a number of foes not usually considered as such, and the damage is mainly confined to the nesting season. The enormous increase of the crow in the West is a danger that cannot be overestimated, and this increase is a comparatively recent condition, as is the tremendous increase of range of the coyote during the present century. The last constitutes the most serious menace to some of our largest and finest species, such as the trumpeter swan and whooping crane.

DEPREDATIONS OF THE "CRAZY LOON"

The provisions of the Migratory Bird Treaty Act may have to be altered in the matter of the protection of such birds as loons and large grebes.

Few people realize the enormous number of loons in the West and their destructiveness during the nesting season. It is as rare to see any fair-sized pond in western Canada without a pair of loons as it is to see a lake in the East with loons on it. Add to this the incredible numbers of the smaller species, especially the Pacific loon along the coast from Mexico to Alaska, and realize that every one of the thousands of loons that you see streaming by hour after hour for days in succession is responsible for the killing of the broods of at least two pairs of ducks, and you can form some idea of the duck destruction that goes on each year unchallenged.

That pair of loons on some lake of our summer vacations that give us such a thrill with their weird cries! How few of their admirers realize that they are, while at their nesting grounds, absolutely intolerant of all intrusion upon their domain by other waterfowl.

Coots also can be very destructive to downy ducks. A swift peck on the soft little pate is all that is required, and their killing propensities are not confined to small ducklings; half-grown birds may be destroyed.

Crows, magpies, hawks, horned owls, muskrats, coyotes, pike, turtles, and other creatures not usually regarded as duck

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A VANISHING AMERICAN IS THE GREAT WHITE TRUMPETER SWAN

Over lonely lake and mountain in northern British Columbia ring the low-keyed, far-carrying calls of this majestic five-foot bird (in flight), one of the continent's largest waterfowl. A few pairs survive also in Yellowstone National Park. Not man, but the marauding coyote on the nesting grounds threatens to send the trumpeter the way of the great auk and the passenger pigeon. Slightly smaller, but far more numerous, are the whistling swans (full-grown in foreground, young in water). From Arctic to Gulf they fly. Long wedges often cleave the upper air high above the earth.

destroyers all take their toll during the nesting season.

How large is this toll? Well, in the region where I have lived for the greater part of the last thirty-eight years, the dry interior of British Columbia, I have attempted each year to keep an estimate of the ducks that reached the flying stage.

HIGH INFANT MORTALITY AMONG DUCKS

This is not a very notable breeding region in point of numbers of ducks, but probably unique in the number of species. Twenty-one species may be found nesting within a radius of 10 miles, while there is hardly a pond of any size but has its pair of ducks. I would estimate the loss in this area from natural predators to be fully 90 per cent, or only ten ducks reared out of 100 eggs laid! I have yet to see any nesting region that would not show a loss of at least 60 per cent.

Consider this waste and it is apparent that stopping the depredations must be one of our major efforts.

Second only to the destruction during the nesting season is the loss from the so-called "duck disease," which is not confined to ducks, but destroys every species of water bird as well as many land birds that drink the contaminated water.

By the researches of a few individuals we now know that this disease is not caused by alkali, as first investigations seemed to show, but is a food poisoning caused by the toxin from bacterial growth in decaying organic matter. The destruction of waterfowl from this cause in some years in the State of California will far outnumber the total killed by all gunners, and the area affected is spreading. It has reached the prairies of Canada in recent years.

The main cause of the plague is the congestion of large numbers of birds undisturbed on certain areas of shallow water. It is not generally recognized that the disease disappears shortly after the opening of the shooting season and asserts itself some three weeks after the commencement of the following closed season.

Any arrangement that may provide inviolate sanctuaries where waterfowl may congest on areas of shallow water will probably insure a death trap that may destroy the birds in millions.

The destruction caused by crude oil is fortunately mainly confined to seacoast areas, and its victims are mostly marine ducks and other sea birds. There seems to be a slight mitigation of this terrible evil in recent years, and by proper preventive measures it can be controlled.

In identification of waterfowl in the field, facility can come only with experience.

Diagrams showing color patterns, at rest or in flight, are of little use unless differences in contour are recorded accurately.

The old wild fowler squints at a flock of birds much too far away to show any color, and instantly identifies them by their contour, wing action, or some character imperceptible to the tyro.

In the air it is usually the under surface that is presented. Mallards are identified by the flash of white below their swiftly moving wings, not by the purple speculum of their upper surface.

In the figures that accompany this article, this character has been specialized as well as the general contour of a duck in full flight, and serious attention has been given to the character and contour of the duck in the water and to the angle at which it carries its head.

Whistling Swan

(Cygnus columbianus)

Whenever I think of swans, one experience stands out. I am standing by the shore of a lake in northern Alberta on a still, dark night in late October, with the black dome overhead spangled with stars and a keen touch of frost in the air. Suddenly comes the clear call of a whistling swan (see Plate I), another, and another, closer and closer, until right overhead there is, I know, a long wedge of birds cleaving their way southward. The thin, whispering whistles of the young form a background for the staccato shouts of the old birds.

Now they have passed, but already from the north I can hear the approach of another flock, and when this in turn has gone, another is heralded by the same magnificent chorus.

Flock succeeds flock. Sometimes the cries seem so near that I strain my eyes upward, expecting to see the stars blotted out, but they must be very high, as not even a whisper of the magnificent pinions is to be heard.

Half the swans of the Arctic are on the way, and I am right in their track. I realize that all the thousands of swans that I have

seen feeding and at rest in the past two weeks are only a fraction of the host that is traveling overhead.

We never need to worry about the whistling swans; even if the present protection were removed, they would be well able to take care of themselves.

The spread of the coyote to the Arctic coast will mean a considerable destruction of their young, but they will always be able to find nesting sites and conditions that will enable them to combat this menace.

Breeding almost entirely north of the Arctic Circle, these swans winter well to the south. Chesapeake Bay and Currituck Sound on the Atlantic and the Sacramento Valley in California are especially favored winter resorts.

Trumpeter Swan

(Cygnus buccinator)

This, one of the largest living native birds of North America, presents a problem for its perpetuation that requires all the intelligence and effort that conservationists can concentrate on it (see Plate I).

The trumpeter is only slightly larger than the whistling swan and the main distinction is the voice. That of the trumpeter has a hornlike quality, very low in key—it might almost be called a groan at times—but possesses an extraordinary resonance. When a flock is passing overhead, the calls do not seem to be particularly loud, but long after, from miles away, the low groaning trumpet comes back, clear and insistent. I do not think the clear whistling shout of the whistling swan will carry half the distance.

I greatly doubt the stories of the former abundance of the trumpeter. Many of these, as well as some of the records of its recent capture, are based on the old diagnosis for distinguishing the two species.

Formerly all adult swans that did not show a yellow mark on the bill were called trumpeters. Now we know that many adult whistlers have an all-black bill, and all other distinctions are more or less unreliable, except the different characters of the windpipe and sternum.

Young birds of the trumpeter also have a lot of yellow on the feet. This is never present in young whistlers.

But the notable distinction and the only infallible one in life identification is the voice, and unfortunately swans have a habit of silence when on the water.

The ranges of the two species are very different. Simply put, the whistler summers as far north as he can and winters far south, while the trumpeter breeds as far south as he can find the necessary solitude and winters precariously as far north as he can find open fresh water.

Formerly the trumpeter nested far to the south of its present breeding range wherever the necessary degree of solitude was available, but the traditions of the Indians do not tell of anything but widely scattered pairs, never of the abundance of the whistler, even in the winter months.

Outside of a few pairs in Yellowstone National Park, the main stronghold of the trumpeter is in northern British Columbia. Possibly 500 birds are scattered through that rugged region in the summer. Concentrations of over 200 birds have been counted recently where unfrozen water was available in the interior, and we know that at other points smaller numbers were present.

Contrary to general belief, they are not molested by man except in rare instances, and even in early days few were shot, although the young birds are excellent eating.

The great danger lies in their enemies on the nesting grounds. Eagles and ravens were probably their chief menace at one time, but now the increased range of the coyote, which has invaded their most inviolate sanctuaries, spells nothing but complete disaster unless some remedial action can miraculously save them.

The old estimates of the great weight of a trumpeter swan are probably all exaggeration. Thirty pounds is probably a fair maximum for a large bird.

Canada Goose

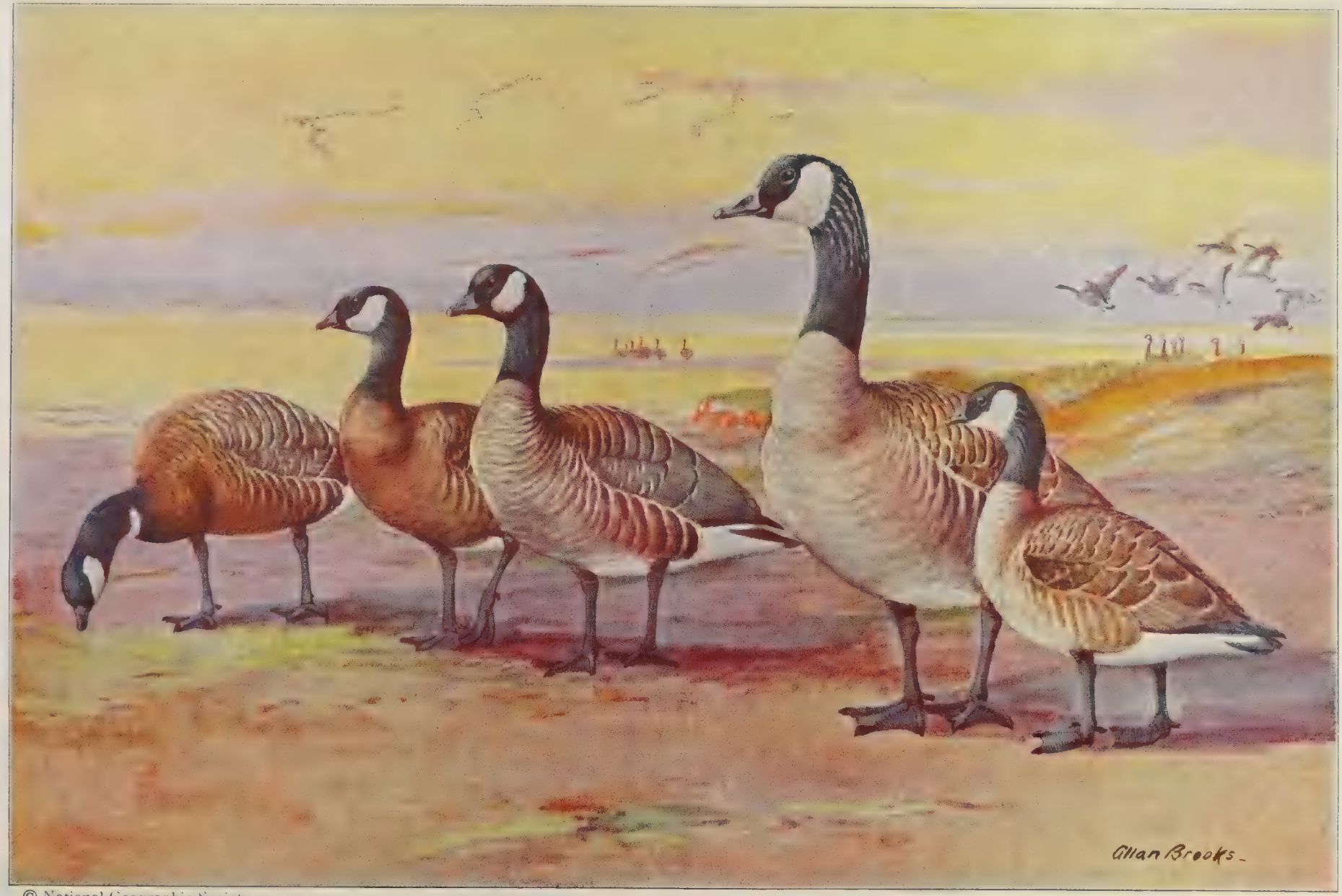
(Branta canadensis canadensis)

"Honker" in the West, "gray goose" in the North, and "outarde" in Quebec are only a few of the names by which this, the largest of our geese, is known (Plate II).

Breeding from the Yukon across the continent to Labrador and south to Quebec and the northern tier of the Prairie States east of the Rocky Mountains, it extends its breeding range south in the mountains to northern California and Utah.

It may winter as far south as Florida and Mexico, but also as far north as the interior of British Columbia.

Everywhere a very wary bird, except sometimes on its breeding grounds, the honker is well able to take care of itself under the existing laws for its protection.



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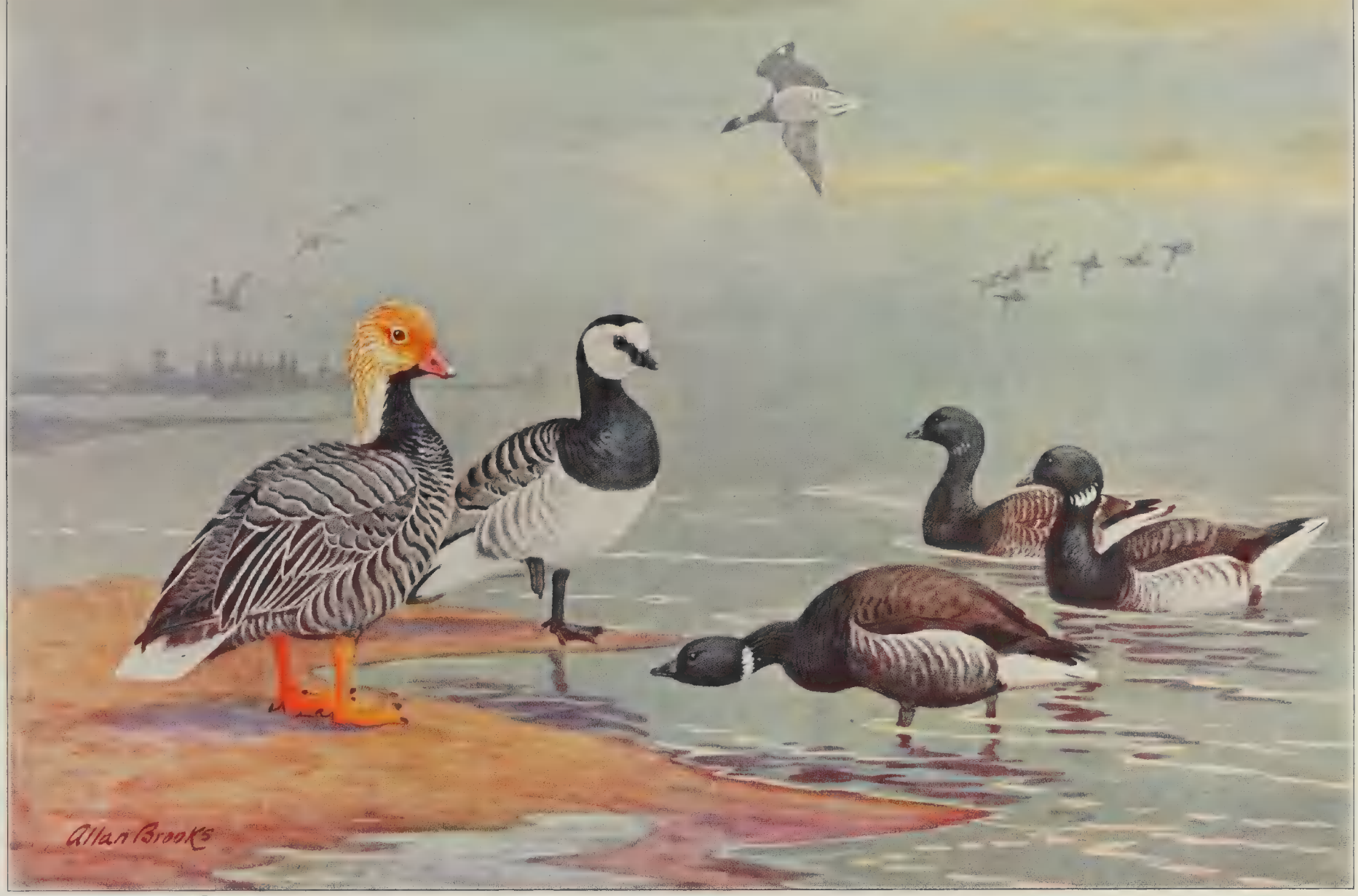
WILD GEESE LOOK AROUND FOR DANGER BETWEEN BITES AND EVEN POST REGULAR SENTINELS

Biggest is the handsome Canada goose, second from the right, whose honking, V-shaped columns etch the sky in spring and fall. Vest-pocket editions abundant in the West are the two cackling geese at the left and the lesser Canada goose in the center. The still smaller Richardson's goose (extreme right) comes from the eastern Arctic.



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BRANT, SMALLEST OF WILD GEESE, RIDE THE WATER GRACEFULLY LIKE RACING YACHTS

A full-grown, white-bellied brant, common along the Atlantic coast, swims with one of its young at the right, while others wheel overhead. A black brant, more abundant in the Pacific, wades ashore. In the Middle Ages men believed geese were hatched from barnacles; hence the name bestowed on the barnacle goose poised on one foot, a straggler from the Old World. The emperor goose at the left lives mainly in the region around the Yukon's mouth.

It is notable among our geese for the variety of its nesting sites. In certain regions it may be found nesting in high cliffs and even trees, although the ordinary sites, such as muskrat houses and islands, may be available.

I have several times seen it nesting in the high-tree nests of the osprey, laying its eggs before the return of the ospreys from their winter homes.

When these hawks return, there is a battle royal. It usually ends in a victory for the ospreys, which lay their own eggs alongside those of the geese and proceed to incubate. What happens if the young geese are hatched out first? Unfortunately, no observer has made any record of this. Possibly it has never occurred, but the mixed sets of eggs may be seen in several museums.

I have never talked with old goose shooters without stories of 20-pound geese coming up, but 14 pounds is my own maximum record.

On the northwest coast from Vancouver Island north to Prince William Sound, in Alaska, a dark race of the Canada goose is resident. This, the white-cheeked goose, *Branta canadensis occidentalis*, has been taken in winter as far south as northern California, but it is always confined to the coastal strip and islands.

It is only very slightly smaller than the typical Canada goose, being merely a dark race induced by the heavy rainfall.

Lesser Canada Goose

(Branta canadensis leucopareia)

This goose occupies an enormous range in western North America. Nesting only north of the range of the Canada goose or along the Arctic rim of the continent north of the tree line, it passes far south in the fall, even well into Mexico (see Plate II).

It is a medium-sized goose weighing from four to eight pounds, and ranging from very dark birds to very light, the latter grading into the typical Canada goose, some individuals being hard to place. The dark, short-necked birds with small bills probably come from the western portion of the breeding range, and are known to the Sacramento Valley gunners as "big brant."

Throughout the interior valley of California, it is the most abundant goose, wintering in numbers that seem almost incredible to sportsmen from any other region.

Here it associates with the other geese of the same approximate size, white-front, snow, and cackling geese. A "V," or line of geese, may be seen with all four of these geese mixed up, yet each conforming to the regular formation.

Richardson's Goose

(Branta canadensis hutchinsi)

This diminutive goose, originally described by Sir John Richardson over a hundred years ago, has been overlooked by more recent ornithologists and only recently has been reëstablished. It is the form designated by the vernacular name of "Hutchins's goose" in the last edition of the American Ornithologists' Union check list. In my opinion it should properly be called Richardson's goose (see Plate II).

It is only slightly larger than a mallard, and a full-sized bird will weigh but four pounds.

Except for its proportionately smaller bill, it is almost an exact replica of the big Canada goose, but less than half the size.

It breeds on the Melville Peninsula and some of the Arctic islands to the eastward, and apparently occupies the same ground as its larger relative, the lesser Canada goose. This does not conform to its present rank as a subspecies. Its migration route is imperfectly known, but it has been taken when migrating at the Gulf of St. Lawrence and west regularly to Manitoba and the Mississippi Valley, wintering in northeastern Mexico.

Cackling Goose

(Branta canadensis minima)

The *"canadensis"* in the scientific name should be left out, as in my opinion this is a full species, nesting along the coast of northwestern Alaska with its larger relative, the lesser Canada goose (Plate II).

Its winter quarters are the Sacramento and San Joaquin Valleys of California, and it has never been taken away from the Pacific coastal strip.

A small goose, only slightly larger than Richardson's goose, it weighs from three to five pounds when in good condition. It is darker in color than the other members of the Canada goose group. Its note is shriller than that of the lesser Canada goose and in its winter quarters, where it is known as "little brant," it is recognized by its loquacity and its short-necked, long-winged appearance, as well as by its erratic flight.

In spite of its limited range it is an abundant species, though less so some years than others. This is probably due to inclement weather during the nesting season, the penalty incurred by all birds that nest in the Arctic.

White-Bellied Brant

(Branta bernicla hrota)

True brant (or brent in the British Isles) are sea geese and their occurrence away from salt water can only be by accident.

Breeding only in the northern part of the Arctic regions, mainly on the northernmost islands, brant extend on their migrations down both coasts as far as Florida and Baja California. On the Pacific side the American, or white-bellied, brant is scarce, being outnumbered by the black brant. Both birds are small, short-necked, long-winged geese, but slightly larger than a mallard and the habits of the two are identical (see Plate III).

The recent disappearance of the eelgrass, *Zostera,* on the Atlantic coasts may spell disaster to the brant, as this is their staple diet and their choice of a wintering ground is governed by the supply of this succulent food. Feeding on it they become extraordinarily fat and one of the most delicious of all waterfowl.

But their natural wariness and the nature of the coast they frequent make their successful pursuit one requiring special knowledge, skill, and equipment, and so comparatively few are shot.

In some winters the brant, like the cackling goose, is notably scarce. Observation will show that the usual family parties of five or six young birds with their parents are absent, and that the flocks are composed of adult birds mainly or entirely. This is the result of a bad nesting season when a continued stretch of rigorous weather in the Arctic has destroyed their nests or possibly even the newly hatched young.

No other ducks or geese can compare with brant in sheer beauty of movement. On the water they sit as lightly as gulls, the tail upraised and the neat little head poised on the graceful neck. Seeking their food, they pick daintily at the water and pivot swiftly to do so. On the wing they are at their best. Sweeping low over the water or mounting high, they can drive into the teeth of a gale that sends other fowl scurrying for shelter, and the chorus of their clanging cries is the music that harmonizes with the crash of the incoming waves.

Black Brant

(Branta nigricans)

The black brant breeds on the Arctic coasts of eastern Siberia and of western America, migrating in winter down both coasts of the Pacific as far south as Baja California and Japan (see Plate III).

Except for its darker coloration and the uninterrupted white collar in front, it is a replica of the Atlantic species. Since the white on the tail and flanks is the same, the bird looks almost as white on the water as its eastern confreres. Its voice, habits and food are identical, and so far it is not menaced by any failure in the supply of eelgrass, although this staple food is certainly not as abundant and luxuriant on the coast of British Columbia as it was 25 years ago.

Nowadays the brant of this region have exhausted the eelgrass supply by the end of January and are forced to a diet of seaweed. They then rapidly lose not only their fine condition but also the delicate flavor of their flesh.

Their method of stowing away the long ribbons of eelgrass is peculiar. It is neatly folded in zigzag fashion as it is swallowed, and an enormous quantity can be packed away by a hungry bird.

Barnacle Goose

(Branta leucopsis)

The barnacle may be called a glorified brant, but in habits it is more nearly akin to other geese, as it comes ashore and grazes on the short grass of coastal pastures instead of seeking its food afloat (Plate III).

It nests sparingly in northeastern Greenland and more commonly on the larger Arctic islands and coasts of the Old World, occurring only as a straggler on the Atlantic coastline of America.

The barnacle owes its name to the ancient Norse belief that these geese were produced from the marine shellfish of that name.

Emperor Goose

(Philacte canagica)

The emperor goose has a very restricted range—the region of Bering Sea and the Arctic coasts of Alaska and Siberia for a short distance east and west. Stragglers are frequently found on the western coast of America as far south as California and even on the Hawaiian Islands (see Plate III).

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HUNTERS PRIZE THE WHITE-FRONTED GEESE, DROPPING DOWN FROM A CLOUDY SKY

The old bird, descending with one of its offspring, wears a speckled vest and utters a laughing cry. They are closely related to domestic geese. Left to right stand Ross's goose, a little westerner; the blue goose, which winters in Gulf coast marshes; and the West's lesser snow

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THE GREEN-HEADED, HANDSOME MALLARD IS AT HOME IN MARSHY WILDS

From this glossy-feathered, quacking citizen of the world and his drably dressed womenfolk (left and "single" flying) many varieties of domestic ducks have sprung. Wilder and harder to domesticate are the East's black ducks (extreme right pair, and flying). The Florida duck (third from right) is a bit lighter colored. The New Mexican duck (center, male) of limited range has only recently been discovered.

It is essentially a marine goose, feeding for the most part on shellfish exposed at low tide, but resorts to the estuaries of rivers to nest on the swampy tundra of their shores. On account of its diet, the flesh is rank and strong-flavored, but this makes no difference to the Eskimo and other natives, who kill these geese in large numbers and freeze the carcasses for winter food. Their numbers are greatly reduced at the present day, according to the records of their abundance made fifty years ago by Dr. E. W. Nelson and L. M. Turner.

White-Fronted Goose

(Anser albifrons albifrons)

Also known as "gray goose," "speckle-belly," and in the Mississippi Valley as "brant," this goose has the widest distribution of any goose, breeding in most of the Arctic and subarctic belt of both the Old and New Worlds (see Plate IV).

Its southward movement starts very early, taking it to southern British Columbia by the first week in September, long before the arrival of other Arctic-breeding geese. The main wintering grounds are to the west of the mouth of the Mississippi and the interior valley of California. Large numbers also winter in northern Mexico. In the Old World the white-front reaches its southern limit in northern India.

At all times and throughout their range, they are excellent table birds.

In the springtime in northern latitudes the laughing cry of this goose proclaims that the "gray waveys are in," and the blue sky is dappled with the lines and V's of the north-bound migrants.

Even after their long flight from their winter quarters, they are in excellent condition, weighing as much as seven pounds.

At certain points in the Sacramento Valley in California, a large edition of the white-front occurs in the winter months. This is the tule goose, *Anser albifrons gambeli,* which owes its discovery and systematic recognition solely to the market hunters of that region.

Their accounts of a white-front almost as large as a "honker," with a darker coloration, distinct voice, and rather different habits from the well-known species, were at first discredited, but when substantiated by specimens the form had to be recognized.

The tule goose when full-grown is not much inferior in size to a Canada goose and weighs as much as nine pounds, with proportionately larger bill and feet than the ordinary white-front.

The mystery of its summer home is as yet unsolved, but the capture of a migrating individual in central British Columbia in the fall of 1933 may afford some clue. Old World naturalists have identified the white-front nesting in Greenland as being the tule goose, this error being due to the fact that they have not seen authentic specimens of the tule goose for comparison.

Lesser Snow Goose

(Chen hyperborea hyperborea)

Snow geese are seldom known by that name by the men who hunt them. "Wavey" is the universal name in the Hudson Bay region and on the Canadian prairies, while in the Western and Southwestern States they are called "white brant" (see Plate IV).

This numerous species nests from Point Barrow, Alaska, east to Baffin Island along the rim of the Arctic coast and adjacent islands. There must also be some nesting ground on the Siberian coast, as large numbers cross Bering Strait in summer to the Asiatic side.

There are three important wintering grounds: the coast of Texas, the northern interior of Mexico, and the Sacramento and San Joaquin Valleys in California. Not that it is confined to these regions; large numbers can be found all winter at the mouth of the Fraser River in British Columbia and possibly even farther north.

Several migration routes have been mapped out for the enormous hordes of these geese, but it must not be assumed that their movements are confined to these routes; they probably represent only the most traveled highways.

Once in the Rocky Mountains of southern British Columbia I saw a large flock of snow geese coming right over the summits from the Alberta side. This was not an isolated instance, there being many similar occurrences in my own experience.

The lesser snow goose probably represents the most abundant goose in North America and the poorest of all gastronomically, the scarce emperor goose excluded.

"They are not bad, made up as sausages," an old hunter of vast experience once said of them, and under special feed conditions they may be excellent; but, as a rule, their flesh is dark and coarse as compared to that of other geese.

Six or seven pounds would be the weight of young and old birds respectively, in good condition.

Enormous numbers of snow geese are killed each year for food, especially in the region of Hudson Bay, where they are preserved for winter consumption, and the very existence of some of the tribes of the region is dependent on this supply.

In California dire predictions of their coming extermination have been made for many years past. While unquestionably their numbers in that State are much reduced from those of early days, it must be remembered that present-day conditions have a tendency to attract geese in enormous flocks to certain areas, and so cause a seeming scarcity in others. The tremendous wastage of rice in parts of the Sacramento Valley must feed thousands of geese that formerly were attracted to the wheat fields and grasslands nearer San Francisco Bay.

My own experience in this region goes back only to 1911, when I saw thousands of geese between Sacramento and the Bay.

In recent years this area has little attraction, but never have I seen a greater concentration of snow geese than I saw in the rice fields near Willows in February, 1933.

Completely restricted in its range to the Atlantic coast is the greater snow goose, *Chen hyperborea atlantica*. This is merely a large, heavy-billed edition of the smaller bird. Its numbers may be said to be confined to one huge flock of many thousand birds which appears at Cap Tourmente, on the St. Lawrence northeast of Quebec city, each year, in October, remaining there until weather conditions compel their withdrawal to more temperate regions along the coasts of Virginia and North Carolina.

The summer homes of this great horde are a mystery, as only isolated pairs have been encountered from the east coast of Greenland to Ellesmere Island.

Blue Goose

(Chen caerulescens)

The status of the blue goose is almost exactly parallel to that of the greater snow goose. Only in recent years have the nesting grounds of their vast hordes been found on Baffin Island. Their southward migration takes them southwest to the Valley of the Mississippi, and they winter in a small area west of its mouth (see Plate IV).

Some systematists regard the blue goose as a color phase of the lesser snow goose on account of the extraordinary variability of its plumage, which is often dappled with varying amounts of white; also, blue geese in captivity have produced young indistinguishable from lesser snow geese. As geese hybridize readily, this last can be explained by such a condition, and in view of the restriction of its nesting and wintering grounds, unless further investigations prove the contrary, it had better be regarded as a full species.

Ross's Goose

(Chen rossi)

The breeding grounds of this tiny goose still remain a mystery. The "warty-nosed wavey," as it is known in the fur countries, arrives at Lake Athabaska from the north in the first week in September, the earliest of the geese. From this general region the route is a peculiar one, as the flocks all pass through the mountains west of Great Falls, Montana, and fly southward to the west of the Rocky Mountains and other ranges of the interior. They winter entirely in the Sacramento and San Joaquin Valleys of California, a most restricted habitat when the vast extent of their migration is considered (see Plate IV).

In California they are known to gunners by the name of "China geese" and now enjoy absolute protection under the game laws.

Although these geese are no larger than mallards, the chief characteristic I have noticed is their pugnacity when in captivity.

Before the ban on live decoys, large flocks of geese of the several species were kept by goose shooters, and it was amusing to see these tiny fellows shoulder the larger species away in defense of their food. I have frequently seen a bellicose little gander keep several large geese away from his feeding family, rushing at them with opened wings and lowered neck.

Mallard

(Anas platyrhynchos platyrhynchos)

Best known of all ducks and the origin of of nearly all our domestic breeds, the mallard is found over the greater portion of the world's surface except South America, Australasia, and parts of Africa (Plate V).

It breeds from the middle row of States south to southern California and north to the Arctic Circle; also over the greater part of northern Asia and Europe. In southern

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WITH ITS "POLICE WHISTLE" THE BALDPATE OFTEN GIVES THE ALARM

Stealing food brought up by better divers is another trait of the baldpate, or American widgeon, mainly found in the West (foreground, male, female; upper left flying). The European widgeon, in water, frequently visits the New World's eastern shore. Above, a swift-winged mother gadwall is about to land just ahead of her spouse and a daughter (upper right).

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MANY A SPORTSMAN FIRES IN VAIN AT THE "GREYHOUNDS OF WATERFOWL"

A brace of the swanlike, stream-lined pintails racing downwind makes but a fleeting target (female and male at right and flying). The bantam resting on one leg, with his mate about to alight, is a green-winged teal, smallest of North American ducks and remarkably quick at leaping into the air. The European teal, swimming, nests in the Aleutian Islands.

Greenland a slightly differentiated race is resident.

One fine June day I came suddenly on a mallard with her day-old brood in a recently flooded pool of crystal-clear water. At the warning quack of the mother, every little duck dived, and as the surface became still I could see the youngsters dotted over the short turf that formed the bottom of the pool. They were not stretched out, but were sitting on the bottom with heads up, their wide-open, beady eyes regarding me through the limpid water.

After watching them for what seemed to me two minutes, I waded in and touched each little form in turn. Instantly they rose buoyantly to the surface and pattered away to join the anxious mother, making no further effort at concealment. Now, by what magic were they able to remain under two feet of water without effort of any sort?

Black Duck

(Anas rubripes)

This splendid duck, which replaces or outnumbers the mallard over a considerable portion of eastern Canada and the Northeastern States, is confined to eastern North America. It has been divided into two geographical races, the northern, true *rubripes*, and the southern, *tristis*. It is fortunate that duck shooters maintain that they are able to distinguish the two; naturalists as a rule cannot. The northern subspecies is called the red-legged black duck. But personally I have yet to see a black duck, even the young birds of the southern form, that did not have red legs (see Plate V).

In spite of the somberness of its plumage, the black duck is a magnificent game duck, the peer of the mallard in everything but color, and excelling the mallard in intelligence and wariness.

Probably it is also larger, as black ducks of four pounds and even a trifle more are on record.

Florida Duck

(Anas fulvigula fulvigula)

This might be called a light-colored black duck, and like that species there is little difference in the sexes. It is confined to the marshes of the Florida peninsula, where it is known to the residents as "native mallard," in distinction from the true mallard, which leaves the region in summer (see Plate V).

The mottled duck (*Anas fulvigula maculosa*) is a slightly darker race of the Florida duck, with a more spotted head. It has a wider range along the coasts of Louisiana and Texas and south into Mexico.

New Mexican Duck

(Anas diazi novimexicana)

This is a fairly recent discovery among the ducks of the United States, and has been described as a link between the mallard and the mottled ducks (see Plate V).

It can be described as a dark-colored female mallard, both sexes being similar.

Unlike the ducks of the black and Florida group, the speculum of the wing is bordered on both sides by white, as in the mallard.

Many individuals show decided mallard characters, suggesting interbreeding, but at several points in New Mexico, where I found it not uncommon during the spring and summer months, I never saw the two species associating together.

Its range in the United States is confined to southwestern Texas, across New Mexico to southern Arizona. Most of the birds pass south into Mexico before the opening of the shooting season in October.

Gadwall

(Chaulelasmus streperus)

The gadwall has probably the widest range of any species of duck, being absent only from South America and Australasia. It is curiously irregular in its distribution, being entirely absent from some localities and abundant in others (see Plate VI).

Owing to its subdued coloration, it is often overlooked where it is scarce, or is confused with other species. It can be told by its yellow feet, this and the wood duck being the only medium or large-sized surface-feeding ducks with this character.

On the wing gadwalls look much like mallards, showing the same white underwing, but in adult birds the under surface of the body shows white like a baldpate.

Their nesting range is rather southerly, few going farther north than the southern portion of the Canadian Provinces. This brings them under the domination of the predatory crow, so that at times a very small proportion of their eggs produce flying birds.

Once I saw a gadwall which had lost her first nest select a strange site for her second effort. The eggs were laid in an old crow's nest in a small tree, where they shared the same fate as the preceding ones.

Baldpate

(Mareca americana)

The baldpate, or American widgeon, breeds from northern California to the Arctic, but mainly in the West. On its winter migration it has been taken as far south as Panama (see Plate VI).

This is one of the commonest of California ducks, and it is hard to realize that the sun-baked birds of the San Joaquin or Imperial Valleys are the same species that you find wintering under severe conditions over a thousand miles farther north.

There is something distinctive about baldpates—their graceful action on the water, sitting lightly with tails held high, pivoting about as they peck daintily from the surface; their way of trotting about like pigeons on the turf, where they graze like little geese; or the splendid evolutions of their flight, when the birds are so closely bunched that there does not seem to be room for the long, pointed wings to function.

Yet they wheel and turn in massed formation like sandpipers. Above all rings the sweeping challenge of the male's musical whistle. On the other hand, the female's note is one of the harshest of all duck sounds—a loud, rasping, rattling croak.

European Widgeon

(Mareca penelope)

The Old World widgeon is easily distinguished from the baldpate, when the adult males are compared, the red head and gray body of the former being very distinctive (see Plate VI).

Young birds and females are more alike, those of the European species being redder and with the axillars, the long, pointed feathers beneath the wing at its base, strongly freckled with gray and not white, or only slightly marked, as in the American species. The European widgeon is turning up more and more frequently, especially on the Atlantic coast, where at some points it is more common than the baldpate.

It breeds in Greenland, Iceland, and Scotland east to Kamchatka Peninsula, wintering south to southern Asia and northern Africa.

American Pintail

(Dafila acuta tzitzihoa)

The pintail, or "sprig," as it is known in California, is a far more common duck in western than in eastern North America. In the West it may be found nesting from Nebraska and California to the Arctic. In winter it migrates as far south as the West Indies and Central America (see Plate VII).

The return of spring on the northern prairies is heralded by the musical whistle of the pintail as soon as the first sign of open water appears. The long flying lines of these graceful ducks, the snowy necks and breasts of the drakes clear-cut against the blue sky—what a thrill this brings after the long months of the white silence of winter!

On the wing the pintail looks like a large duck—as large as a mallard; this fact is due to the long neck and wings. Actually it will weigh but little more than a baldpate or gadwall in good condition, about two and a half pounds.

Green-Winged Teal

(Nettion carolinense)

This, the smallest of our ducks, may be found in summer from about the limit of trees in the Arctic south to New Mexico and California at higher elevations. On the coast of British Columbia it may be found throughout the winter, but in the interior the rigor of the winter usually sends it south before January. The southern limit of its winter migration is in southern Mexico and the West Indies (see Color Plate VII).

Green-wings are usually rated as the last word in gastronomic delicacies, but this is not the case where they have access to the salmon-filled rivers of the Northwest. It is an extraordinary sight to see these lovely little birds in such surroundings. They scuttle over the rocks and gravel, shoveling up the masses of maggots in the rotting fish or working the shallow riffles for salmon eggs.

It is well to know what ducks may be classed as safe to eat when the salmon are running.

I have never found any of the following species indulging in this accessible but disgusting source of supply: pintail, baldpate, blue-winged and cinnamon teal, shoveller, and wood duck. All other ducks should be avoided under such conditions, but the taint can usually be easily detected in birds that have been indulging in this diet. Ruffle the breast feathers and the putrid smell is evident.

Of all ducks the newly hatched young of the green-wing are the most beautiful. The tiny balls of silky, olive-brown fluff marked

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THE SHOVELLER USES ITS LUDICROUS BILL AS A GOLD MINER DOES HIS PAN

"Nuggets" sifted out of the mud are worms, tadpoles, shellfish, and seeds. Some shovellers, or "spoonbills" (left pair and alighting in distance) fly more than 2,000 miles over the Pacific Ocean from Alaska to their winter home in Hawaii. Small relatives are the West's cinnamon teal (pair in center) and the blue-winged teal (pair at right and trio flying at top), which sometimes migrate to central Chile and Brazil, farther south than any other North American duck.

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LORDLY BEARING STAMPS THE CANVASBACK A KING AMONG WATERFOWL

Hardy and strong, splendid flyers and divers, "cans" often stay in the north until the lakes are covered with ice (right pair and "single" flying). From breeding grounds in the far north and west many head for Chesapeake Bay regions, where they feed on "wild celery." Often flights of thousands parade across the sky. Close relatives are the redheads (pair in left foreground and group flying) and the ring-necked ducks (beyond), most widely and aptly called "ring-bills."

with golden yellow are a delight to the eye, and the picture of the little mother with her brood of maybe ten midgets, tightly massed and swimming close to her tail, is one never to be forgotten.

The nest also is a pretty thing, usually at some distance from the water, tucked away at the base of a small bush or bunch of flowers, the olive-cream eggs concealed by a blanket of dusky down.

The spring note of the male is very like that of the pintail, but in a higher key—a soft, broken little whistle often repeated.

European Teal

(Nettion crecca)

This, the Old World representative of our green-wing, has occurred casually and frequently along the Atlantic coast from Greenland to North Carolina. No doubt it occurs on the Pacific, as it breeds on the Aleutian Islands, but it may be easily overlooked. The females are indistinguishable from those of the green-wing. In the male the white crescent in front of the wing is replaced by a longitudinal line of white bordered by black on each side of the back (see Plate VII).

Blue-Winged Teal

(Querquedula discors)

The blue-wing is essentially a more southern species than the green-wing and its northern breeding limit is much farther south. It has been found nesting in almost every State in the Union and Canada, while its normal western limit is through the central portion of the western Provinces, although it is occasionally found farther north. It extends its winter migration farther south than any other North American duck—as far as central Chile and Brazil (see Plate VIII).

Its decrease in recent years on the Atlantic coast is marked by an increase on the Pacific. During the last few years this increase has been especially notable in British Columbia, where its gain is at least 500 per cent over the numbers of 20 years ago.

Much has been written regarding the great speed of the flight of the blue-wing. In this respect it should not be classed as swift as the green-wing, and most of the estimates of the speed of both species should be cut in half. Several times when traveling on a train going about 35 miles an hour, I have seen blue-wings flying parallel make several efforts to pass in front of the engine before they were able to do so.

The white patch in front of the eye and another in front of the tail, together with the dark coloration, make the drake blue-wing a conspicuous bird in summer, but all these characters are lost by mid-July, and the males are practically the same color as the females. The old drakes leave for the south before August, and I have never seen one among the bags of teal at the commencement of the shooting season. The full plumage is not acquired until after December, later than in any other duck.

In weight they will average two ounces heavier than a green-wing, or about one pound as a maximum.

Cinnamon Teal

(Querquedula cyanoptera)

This is a western duck, only stragglers of which have been found on the Atlantic coast, and it has a more southern breeding range than the blue-wing (see Plate VIII).

The center of its abundance is in the interior valleys of California, although it is fairly common in summer north to about latitude 52°. East of the mountains, it becomes scarcer and it is a rare bird in Montana or Saskatchewan.

Cinnamon teal in the summer are confiding little birds, and it is a pretty sight to see the handsome red male with his inconspicuous spouse sunning themselves among the bright-green grasses at the margin of some small pool. They allow a very close approach before the female jumps into the air, closely followed by her handsome mate, and usually they will settle again within 40 yards, or else return to their starting point.

The females and young of the cinnamon and blue-winged teal are practically indistinguishable. Although works of reference point to differences in the size and shape of the bill and color of the breast, these distinctions are not infallible. In spite of this similarity among the females, hybrids are of exceptional occurrence, even when the two species are kept in confinement together.

I have twice seen fights between males of these two ducks. In each case the cinnamon was the winner.

Although classed as a teal, this duck, as well as the blue-wing, is more closely related to the shovellers, both in structure

and coloration, as well as feeding habits. This affinity is very apparent when the species of shoveller inhabiting South America and Australia are compared. The South American shoveller is colored like a cinnamon teal, while the Australian has the markings of a blue-wing.

Shoveller

(Spatula clypeata)

The shoveller, more commonly known as the "spoon-bill" or "spooney," has, like the gadwall, an almost world-wide range. In the New World it reaches in summer to the subarctic regions, but the main nesting ground is on the prairies of the Canadian Provinces and the northern tier of States. In winter it reaches Central America and even the Hawaiian Islands (see Plate VIII).

Aside from the tremendous bill, the shoveller is full of character. When feeding it is a dabbler, sifting the mud through its specialized bill with a lateral motion, rarely tipping up as other surface-feeding ducks do. It rises from the water with a jump, and the rattle of its wings as it does so can be picked out above the noise of other rising ducks. When settling this rattle is once more in evidence, and it alights almost vertically with hardly a splash.

The old historians, such as Alexander Wilson, rated it high as a table bird. "An old hunter will never pass up a spoonbill even when after canvasback." But anyhow, in the West it is not ranked so highly, and it is seldom shot where better ducks are available.

When first hatched the young have a bill shaped as in other surface-feeding ducks, without any evidence of the spatulation that characterizes the older birds.

In size the shoveller is small medium, a fat bird weighing one pound twelve ounces.

Canvasback

(Nyroca valisineria)

This fine duck, so often called the "lordly" canvasback, is distinctly an American bird and has never been recorded outside of its North American range. It breeds from Alaska and Great Slave Lake south to northern New Mexico and in winter reaches well down into Mexico (Plate IX).

Epicures first made the canvasback's reputation, and along the Atlantic States where it can get a plentiful supply of its favorite food, the wild celery (*Vallisneria*), which grows so abundantly in the brackish water of Chesapeake Bay and other similar inlets, it is certainly an outstanding bird. But where this water weed does not grow, the canvasback is not superior to the redhead or many species of surface-feeding ducks. On the bays of the Pacific coast, where shellfish form its principal diet, it becomes almost uneatable.

With the canvasback we start the series of diving ducks, and with its huge paddles of feet, heavy body, and rather small wings, it forms a typical representative of this group.

Aside from its reputation as a table delicacy, there is something regal and outstanding about the canvasback. All its actions are full of character. The big white body that seems to sit so high on the water, surmounted by the slender-shaped head on the long, thick neck, forms a striking picture.

But when a flock is in full flight the big birds are seen at their best. There is such power expressed in the speed and directness of their driving flight, usually made in line formation, that it seems to stamp the "can" as a superduck wherever it is found.

On its nesting grounds it is an early breeder. A full month before its congeners, the scaups and redheads, have started to lay, you can find the female seated on top of a huge pile of rushes, often anchored in water two feet deep and some distance from the shore, with very little attempt at concealment.

She often has a trick of choosing some small pond or slough quite a distance from the larger one that is frequented by the lordly males. Very soon these desert the breeding grounds and leave to the females all the cares of the coming family.

While the canvasback is no larger than a mallard, it is a heavier bird. I would regard four pounds as a maximum weight.

Redhead

(Nyroca americana)

The redhead has a decidedly more southern breeding range than the canvasback, ranging from the center of the Prairie Provinces and British Columbia south to southern California. In winter it does not reach farther south than Mexico (see Plate IX).

The redhead is one of the least maritime of all diving ducks. On the Atlantic it may be found on the brackish inlets, like Chesapeake Bay and Pamlico Sound, in large numbers, but on the Pacific it is practically

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THE RUDDY DUCK IS KNOWN BY 61 DIFFERENT NAMES

With fanlike tail, bull neck, and pugnaciously uptilted bill, a ruddy, alias "fool duck," "sleepy duck," "blatherskite," and so on, proudly escorts his lady. Near the shore, fat male ruddies in winter plumage struggle to rise from the water. Two lesser scaup ducks, sometimes called "blackheads" and often seen in huge rafts on the bays and inlets of the Atlantic coast, swim toward the left, leading a pair of greater scaups, also portrayed above in flight.

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NATURE DAUBED THESE DUCKS WITH BOLD, WHIMSICAL STROKES

Fantastic is the harlequin, perched on the rock with his mate, while others fly overhead. The pair in the right foreground and the "single" above are American golden-eyes, nicknamed "whistlers" from the sound of their wings. At the left is a cousin, Barrow's golden-eye. Just in front of the rock and flying low over the water are small kinsmen, buffleheads. The male, with broad white bonnet, has a "swelled head" when he erects his feathers.

unknown on salt water. This fact makes it one of the best of all diving birds for the table.

It is a beautiful sight in southern British Columbia to see the return of the redheads at the first sign of spring to the large lakes of the interior. The first break of the winter conditions used to bring them pouring in (I say used, for they no longer do so) until many hundreds were bedded together out in deep water. These were at first nearly all males in high condition both as to weight and plumage. As darkness fell, the air was filled with the mewing call of the males, exactly like the mew of a cat. This is the spring note, and I have never heard it in the fall.

I know of no lake in the Province where this early movement occurs nowadays, and the birds have quite changed their habits, being found on the small upland ponds where they never used to occur. To nest they resort to lakes with a heavy growth of rushes. One lake close to my home has as many as 300 pairs on the three miles of its length. But hardly any young are reared, although crowds of the little golden downies may be seen in the rushes in July and early August.

One year the nests were badly drowned out by the damming of this lake for irrigation supply; so the ducks laid their eggs in any kind of nest that survived. Some extraordinary combinations of mixed eggs were to be seen.

A little pied-billed grebe whose floating nest had survived was having a hard time, as, in addition to her own eggs, three coots' and two redheads' had been imposed upon her. The little mother was furiously engaged in trying to eject the latter, three times the size of her own, and I saw her at last succeed in rolling one of the huge eggs into the water.

Even under ordinary conditions some ducks have this cuckoolike habit and the redhead is particularly casual in this respect.

Redheads may be classed as large-sized ducks, but the weight of even large, fat birds will be under three pounds.

When feeding in deep water—and they can bring up their duck-weed food from a depth of 40 feet or more—redheads are commonly attended by baldpates and coots. Both of these watch the redhead's return to the surface, its bill full of weed, and this is deftly tweaked away, without any protest from the much-enduring redhead, which at once proceeds to dive for a fresh mouthful. This goes on for hour after hour until all are satisfied.

Ring-Necked Duck

(Nyroca collaris)

"Ring-bill" is a commoner and much more appropriate name than ring-neck for this little duck. The ring on the neck is an obscure character confined to the old males, but in life the two bands of brilliant white on the bill are a conspicuous character in both sexes (see Plate IX).

"Black-jack" is another common local name, but this is also shared with the lesser scaup.

The range of the ring-neck is very much the same as that of the redhead, even more southerly, and it is rare or absent from the New England States and along the northeastern coast of Canada.

Usually the ring-neck is compared to a lesser scaup, which it resembles in size; also, the black heads of the males are similar. But actually it is a very close relative of the redhead, the female ring-neck being a miniature of the female of that duck.

Ring-necks are very fast flyers; few ducks can equal them when going at full speed.

Of late years the species has shown a decided decrease throughout its range. That may be only temporary, as it has always been a duck which showed wide fluctuations between abundance and scarcity.

Ring-necks are usually exceptionally fat and will weigh from one pound and a half to a few ounces heavier in this condition, which classes it as a medium-small duck.

Greater Scaup

(Nyroca marila)

Scaups, more generally known as "bluebills," "blackheads," and "raft ducks," are divided into two species, the great similarity of which is responsible for much confusion, especially in the delimitation of their nesting ranges (see Plate X).

The greater scaup is an Arctic-nesting species, breeding along the northern rim of the continent north of the tree limit, east to the Hudson Bay region; it winters as far south as California and the Gulf of Mexico, where it is much scarcer than the lesser scaup.

It is also found over the whole northern portion of the Old World.

Scaups are hardy birds and the most maritime of the "pochard" group of ducks, which includes the canvasbacks, redheads, and ring-necks in America.

In the stormy waters of our northern coastline they can be seen holding their own with the typical sea ducks—eiders, scoters, and old-squaws—diving just outside of the line of tumbling breakers for the shellfish which constitute the food supply of all these birds. At such times they are "fishy" and practically uneatable, but when found inland their food is much the same as a redhead's and they are then excellent eating.

Greater scaups may be called large medium ducks, weighing in good condition about two pounds, with two and a half as a maximum.

Lesser Scaup

(Nyroca affinis)

Lesser scaups are much smaller-sized birds than the preceding species, but even at that the weights will overlap. To distinguish them reliance must be placed on the much smaller bill, the purple instead of green reflections on the head, and the smaller extent of white on the wing in the smaller species. The last-named character is the most reliable, the inner primaries, or long flight feathers, having their outer webs white in the greater scaup and pale brown in the lesser (see Plate X).

The breeding range of the lesser scaup is well to the south of that of the greater. It extends well up into Alaska and northern Canada, south to the northern Prairie States and southern British Columbia. Throughout this range it is one of the commonest ducks, nesting both in small ponds and larger lakes, wherever plenty of cover is available. For this is a marsh breeder and the nest is always close to water and usually has a waterway, such as a muskrat's passage, leading to it. It is a late nester and young broods are sometimes unable to fly when the first ice of the early northern fall is forming.

The "little blue-bill," the commonest name of this duck, is of universal distribution, but generally speaking it is more of a marsh lover and less of a seacoast duck than its larger relative. In the winter it is the common and confiding duck you see along the Indian River in Florida, on the bayous of Louisiana, or the sloughs of California, and it is seldom molested where better ducks are available. Under such conditions it often becomes so tame that it will take bread from the hand.

At its nesting grounds it is equally confiding and I have often stroked the sitting birds as they sat on their nests. An exceptionally charming sight was a drove of 40 dusky ducklings headed by one mother, while the other three females acted as whippers-in of their united broods. This was on their breeding grounds in central British Columbia.

Lesser scaups may be classed as of small medium size, or exactly the same as the ring-neck in weight.

Ruddy Duck

(Erismatura jamaicensis rubida)

No bird rejoices in a greater assortment of vernacular names than this curious little duck. A full list of these may be found in Dr. J. C. Phillips' wonderful work, "A Natural History of the Ducks." In few regions of America is it known to duck-shooters by the same name. Many of these are attractive in their vulgarity and depict the comical appearance and quaint actions peculiar to this duck (see Plate X).

The ruddy is a duck of southern distribution, nesting from southern Canada through all the States into Mexico. It is notable among ducks for many characteristics. Chief of these is the faithfulness of the male in his parental duties. As soon as the young are hatched—and these are huge compared to other downy ducks—the male escorts them in all their forays for food. Not that he interrupts the continuance of the bobbings and gulpings that constitute his display during the breeding season, but he ever keeps a watchful eye for danger, ready to fight any bird or mammal, regardless of size, that threatens his charges.

This courage, not to say irascibility, is common to both sexes. I once found a small female being tumbled about in the surf of the Pacific. Slammed down on the sand by each breaker, she pulled herself together and met the towering descent of the next with wide-open beak and stretched to her full height. I managed to capture her and carried her across the sand dunes to a spot where I had my canoe on a protected lagoon.

Placed on the floor of the canoe, she kept up a determined attack on my feet until I released her at a suitable haven, where she sat on the water scowling at her deliverer.

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MOTHER EIDER DUCK LINES HER NEST WITH DOWN PLUCKED FROM HER OWN BREAST

In Iceland and parts of Europe man provides nesting sites and in return takes some of the eider down for quilts and coverlets. In the right

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ESKIMOS KILL EIDERS WITH CLUBS AND MAKE THE SKINS INTO CAPS

A favorite victim is the spectacled eider (left pair and "single" flying) when in summer it is molting and cannot fly. Pacific eiders, lazily floating in center, are the largest of North American ducks. In contrast, Steller's eider (right pair) is small, trim, and swift on the wing. All three kinds live in the freezing waters off Alaska and Siberia.

A final wave of the paddle towards her was regarded as an insulting climax and she hurled herself forward, seized the paddle in her bill, and hung on like a bulldog.

There is a marked discrepancy in size between the sexes of the ruddy duck. The male might be called small medium, slightly smaller than a little blue-bill, about a pound and a half. The female is decidedly small.

The wonderful color of the bill in the male must be seen to be appreciated. During the nuptial season it is a vivid turquoise blue, and this, with his bull neck, striking colors, and tail held cocked over his back like a wren's, make him notable in any company. In the fall and winter the plumage changes and the bill is dark gray.

American Golden-Eye

(Glaucionetta clangula americana)

More commonly known as "whistler" or "whistle-wing," the golden-eye belongs to a group of ducks characterized by striking pied plumage in the males and a tree-nesting habit. The last character limits their nesting range to regions where trees are large enough to afford them nesting sites.

The American golden-eye's breeding range follows the tree limit of the subarctic forest and extends south to southern British Columbia and east through the northern tier of States to Maine. Its winter range is governed by the ability to find ice-free water, but on the Pacific coast it extends to Baja California (see Plate XI).

Golden-eyes of both species are notable for the chiming music of their flight; this whistling is peculiar to the old birds, especially the males. Younger birds fly with no more noise than other ducks.

They nest in hollow trees and very often they have to go far from the nearest water to find a suitable hole. This entails a long tramp for the newly hatched brood, often over rough ground, and these journeys are fraught with many dangers from predatory birds and mammals.

Settlers in regions where golden-eyes nest are often surprised by females coming down their chimneys while searching for suitable nesting holes, while in the Old World the habit is turned to account by putting up nesting boxes and utilizing some of the eggs and down.

As in all the members of this group, the male golden-eye is very much larger than the female and weighs as much as two and a half pounds in good condition. Females may be called small medium in size, with a weight of one and a half pounds.

Young males are nondescript-looking birds and do not acquire the full plumage until their second winter.

The golden-eyes of the Old World are slightly smaller than the American subspecies.

Barrow's Golden-Eye

(Glaucionetta islandica)

Barrow's golden-eye and the harlequin duck are alike in possessing an extraornary range. Both breed in Iceland and southern Greenland, and also in the Rocky Mountains and the region from these mountains west to the Pacific. But their summer homes are almost or entirely deserted in winter, the ducks of the Iceland colony being found along the northern American coast from Newfoundland to New England, and those of the mountains wintering on the Pacific coast (see Plate XI).

In the regions between these two colonies the species are unknown except for a very occasional straggler.

Barrow's golden-eye is also notable in being a thoroughly distinct species which any child could separate in the plumage of the adult male, but the females and young males are almost indistinguishable from the American golden-eye. The shape of the bill, which in Barrow's is tapering, with a raised nail, is the infallible distinction.

In the interior of British Columbia Barrow's golden-eye is a common bird. Every pond in the rolling foothills has a pair or more, as soon as it is free from ice in the spring. By early June the handsome drakes have returned to the seacoast from whence they came, and soon after the females and their broods may be seen. The latter are pitifully small as a rule. On their journey from some hollow tree, a long way back in the wooded hills, they have had to run the gauntlet of various enemies.

Even when the lakelet is reached, their troubles are not over. Crows and magpies watch for every chance to get a duckling separated from the mother, and the latter as well as the young may fall victim to the red-tailed hawks nesting in the neighborhood.

These hunt the ducks in exactly the same manner in which the bald eagle gets them in their winter quarters—they follow the course of the diving birds while hovering over the victims and pick them up deftly as they come to the surface.

"Broods" of one are common and once I saw a single young one attended by two mothers, one a golden-eye and the other a bufflehead.

But for this incessant persecution Barrow's golden-eye would be a common species, as the birds have almost all left for the salt water, where no one molests them, before the opening of the shooting season.

A few Barrow's golden-eyes winter in rapid water of mountain streams, where even an occasional old drake may be seen at that season. These birds seem to be visitors from the northern mountain region and arrive in winter after the resident birds have left for the coast.

Bufflehead

(Charitonetta albeola)

The bufflehead is another duck that is peculiar to North America and of an unique type. Like the golden-eyes, its breeding range is governed by the character of the country that affords it nesting sites. This is found from the Hudson Bay region through the northern Canadian Provinces to Alaska and south in the mountains to northern California. In winter it extends to Florida and Mexico; also, as a straggler, to Bering Island, Hawaii, and the British Isles (see Plate XI).

Buffleheads, or "butterballs," as they are usually called, have a reputation for diving "at the flash," which does not seem to be warranted when they are compared to other diving ducks. Old-squaws and harlequins have always seemed to me to be quicker.

At their nesting grounds they are more than usually engaging; even while the males are still displaying to attract the females, the latter are apt to fly off in search of a nesting hole. These, in my own experience, are invariably the nest holes of the flicker, which run between three inches and three and three quarters inches in diameter.

In selecting the hole, the little female clings to the edge like a woodpecker and peers into the depths of the cavity. The ivory-colored eggs are laid on the chips at the bottom of the hole and later a mass of white down is added. Several times I have sawed out the hole with a keyhole saw right down to the sitting bird, and on lifting out the front the little duck would be disclosed snuggling in the snowy puff of down.

Like the golden-eyes, the female is much smaller than the male. The latter can be classed as small, weighing about a pound and a quarter, but the tiny female weighs less than a pound.

Harlequin

(Histrionicus histrionicus)

The harlequin has been divided into an eastern and a western subspecies, but the distinction is barely recognizable. Under "Barrow's Golden-Eye" allusion has already been made to its extraordinary distribution. Harlequins are exceptionally maritime ducks, frequenting the outer reefs. Here they feed in the tumbling surf, climb out on the rocks to rest, and run nimbly to their topmost peaks. It is exceptional to see them in quiet inlets or bays in the winter (see Plate XI).

When the spring is well advanced, harlequins appear on the mountain lakes of the interior, from Alaska to California, and ascend the rivers until these become foaming torrents of glacial water. Here is their summer home, and they find the turmoil of these cascades as easy to negotiate as the breakers of the storm-beaten coast.

As soon as the eggs are laid the males desert the females and reappear on the seacoast, often hundreds of miles from their nesting quarters. Here they molt their striking plumage to one that resembles the female dress, becoming flightless as the wing feathers are shed. Flocks of these "flappers" may be observed, giving rise to the stories of young broods on salt water.

Females and young follow in the early fall as soon as the young can fly, and at only a few points can the harlequin be seen throughout the winter anywhere in the interior.

The nest is made in a cliff, steep bank, or log jam.

The harlequin is a small medium duck, about the same size as an old-squaw, and like that duck the sexes do not differ much in size, being about a pound and a half in weight when in good condition.

Old-Squaw

(Clangula hyemalis)

The old-squaw, or long-tailed duck, is a circumpolar species, being found without variation in the northern portions of both hemispheres. In America it breeds on all the Arctic tundras from Atlantic to Pacific and south along the mountain ranges into extreme northern British Columbia. In winter it can be found at times as far south

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UNEASY ACTIONS OF AMERICAN SCOTERS SOMETIMES FORETELL A STORM

Largest of these tough, deep-diving "sea coots" is the white-winged scoter (right pair, and young drake taking off). The surf scoter (left,

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THE MERGANSER'S BILL IS EDGED WITH SAWTEETH SO THE BIG ONES WON'T GET AWAY

Even during a New England winter "sawbills" may be seen, swimming and diving for fish in the cold open stretches of a rapid stream. They usually nest in hollow trees. Rivers and other inland waters are frequented by the American merganser (left foreground, drake and hen). The beautiful hooded merganser, on the dead limb with his mate, likes small ponds. Both seacoasts and inland waters are visited by red-breasted mergansers, pair swimming and drake in swift flight.

as California and Florida on the seacoasts and many winter on the Great Lakes (see Plate XII).

Here they are caught at times in nets set in deep water for ciscos, a species of herring. In 1917 Mr. W. E. Saunders, investigating reports of large numbers being caught and utilized for fertilizer, found at one factory 12 tons of these ducks, estimated at 1,500 birds to the ton.

On the Pacific coast the old-squaw is decreasing each year. Not more than 10 per cent of their former abundance can be found on the waters around Vancouver Island, and no cause, such as the catastrophe of the Great Lakes, is apparent. As it is never hunted in these regions by man, the loss must occur at the nesting grounds and may be caused by loons.

The old-squaw is a vivacious duck, both when swimming and in flight. On the water the tail is carried low; when feeding, often dragging on the surface; but when courting and displaying, it is held almost erect and the male then presents a beautiful appearance. Sitting lightly on the water, with head held high, he utters his musical cry again and again. This cry has been syllabified in nearly all its vernacular names and, as Dr. Phillips puts it, "more ink has been devoted to describing the call of the male than is the case with any other duck."

The call must be heard to be appreciated fully. It has the sweep of a saber in its final inflection and the emphasis on the second syllable is the keynote. Probably its New England name gives the best idea of this—"South-south-southerly." The call is repeated again and again on the wing, and in flight no duck can surpass the old-squaw.

The short neck and long, pointed wings, dark above and below, are the field marks that distinguish it. In flight the bird is impetuous, tilting from side to side, and as erratic as a sandpiper or plover.

King Eider

(Somateria spectabilis)

Eiders are specialized sea ducks with peculiarities of coloration common to all the species that comprise the group. The drakes have black or dark underparts with the back mostly white, and all have more or less "eider green" on the head. The females are handsomely marked and suggest the coloration of some of the larger species of grouse. Both sexes have the tertials, the basal flight feathers of the wing, strongly sickle-shaped. Except for one species, they are all large to extra large-sized ducks (see Plate XII).

The king eider is of circumpolar distribution, nesting along the Arctic coasts of both hemispheres and wintering for the most part along our northern shores. Of all the eiders it is the one that is most likely to be taken south of its natural range as a straggler, and has turned up as far south as California, Georgia, and some of the Central States, as well as frequently on the Great Lakes.

The keel-like erection on the forehead at the base of the bill in the male is a seasonal adornment, shrinking materially at the close of the breeding season when the drakes go into eclipse, and assuming its fullest expansion only as the nuptial season returns.

This eider is a very large duck, although considerably smaller than the Pacific and American species.

American Eider

(Somateria mollissima dresseri)

The American eider, a subspecies of the eider of the Old World, nests from the southern portion of Hudson Bay and Labrador south to the coast of Maine. In winter it is found but little south of its summer range, rarely as far south as Virginia (see Plate XII).

Like all the eiders, this is very much of a sea duck and, like the harlequin, it frequents the outer reefs and rocky stretches of storm-beaten coast. The food is almost entirely shellfish and the flesh of all eiders is strong and rank in consequence. They are now protected at all times in the United States and Canada, except on the Arctic coasts.

Eiders are among the best known of ducks, owing to the quality and commercialization of their down. On parts of the Canadian coast this is affording a considerable revenue and eventually the "farming" of the birds will be as carefully systematized as it is in Iceland. There the protection of centuries has produced a semi-domesticated condition where the ducks have nesting places made for them, sometimes even inside the homes of the people, who take the first layings and the down.

The spring notes of the male are a musical cooing, but without the resonance of voice that is found in the old-squaw.

One of the largest of ducks, the American eider will weigh five to five and a half pounds when fat.

In Greenland, northern Labrador, and west to the northern Arctic islands, a closely allied subspecies occurs—the northern eider, *Somateria mollissima borealis,* differing mainly in bill characters. This form is found associated with the resident American eiders in winter as far south as Connecticut.

Pacific Eider

(Somateria V-nigra)

This, the largest of North American ducks, replaces the species *mollissima* on the western Arctic coasts of America and the eastern portion of Siberia, also nesting on the Aleutian Islands and the Alaska Peninsula. On account of its range along the Arctic coast, it is very likely to occur in winter in the interior of America and has already been taken twice in Manitoba.

The principal mark of distinction from the eiders of the Atlantic is the conspicuous black V, point foremost, on the white throat of the male, from which it gets its scientific name (see Plate XIII).

In habits it does not differ from the Atlantic species, but no attempt has been made to commercialize its down product. Large numbers are shot by the Eskimos for food, even in the spring, but it still persists in vast numbers in its Arctic habitat.

I can find no record of its weight, but as it is considerably larger than the Atlantic species, this must be in the neighborhood of six pounds.

Spectacled Eider

(Arctonetta fischeri)

No bird or mammal better deserves its common name than the spectacled eider, the eyes in the male being surrounded by short, velvety feathers with a black rim around the outer edges of these circular patches. Even in the female these "spectacles" are defined in light-colored patches around the eyes (see Plate XIII).

A duck with a very restricted range, the spectacled eider breeds along the Arctic coast from Point Barrow westward and down the coast of Bering Sea to the mouth of the Kuskokwim River. Even in winter it is not found much to the south of this region. In Siberia it is found west to the Lena River.

The spectacled eider feeds in shallower water than do most eiders and is said to dabble or "tip up" like surface-feeding ducks to some extent.

Although a large duck, it is smaller than any of the preceding species of eiders.

Steller's Eider

(Polysticta stelleri)

The smallest of the eiders, this species is of the same proportionate size to the larger species that a teal is to a mallard.

In northwestern America Steller's eider nests throughout the same restricted area as the spectacled eider, but is found much farther along the Siberian coast than that species. In winter it is found as far south as the Kurile Islands and eastward to northern Norway. It may even nest in the latter region (see Plate XIII).

Steller's eider is a trim duck with little of the heavy appearance of other eiders, and the shape of the bill suggests that of the extinct Labrador duck (p. 486). But the coloration is essentially that of an eider and the sickle-shaped tertials are similar.

It is a frequenter of rocky shores and seeks its food in deep water, often in company with harlequins and old-squaws.

On the wing it is very swift, as might be guessed from its long wings which whistle like a golden-eye's.

White-Winged Scoter

(Melanitta deglandi)

Scoters are sea ducks of large size and dark coloration, black in the males and dark brown in the females. They are not confined to salt water but require large bodies of deep water for their inland homes. Five species are found throughout the Northern Hemisphere, of which three are North American (see Plate XIV).

The white-winged scoter is represented in eastern Asia by a closely allied subspecies, the Asiatic velvet scoter, and in Europe by the European velvet scoter, *Melanitta fusca;* the latter has occurred in Greenland. The white-winged scoter is the commonest of the three American species. It nests from Alaska to Ungava Bay, south to North Dakota and the Gulf of St. Lawrence. In winter it is found in large numbers along both coasts south to South Carolina and Baja California, on the Great Lakes and many inland bodies of water.

On the Atlantic coast the "white-winged coot" is hunted to some extent, but on the Pacific it is rightly regarded as unfit for

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A MASTERPIECE OF NATURE IS THE WOOD DUCK'S GORGEOUS SUMMER COAT

He clings to the dead branch just below his less showy spouse, while another pair flies above them. True to their name, they often wander into the woods, far from water, to eat insects or swallow acorns whole. Their nest is in a hollow tree, or even in a farmer's hayloft, and their numbers are increasing, thanks to protection. From the South come the long-legged and broad-winged tree ducks (black-bellied, extreme right; fulvous, left and flying above). The sleek and elegant Bahama duck (lower center) occasionally reaches American shores.

food even by the coast Indians, who have a decided penchant for the *haut goût*. The latter eat gulls, guillemots, and even eagles, but as for a scoter, "too much smellum inside," as an old Haida told me. Around the wharves of many Pacific ports these scoters can be seen diving along the piles beneath one's feet and they are equally at home in the surf of some wind-swept shoreline.

It is a fine sight to see the overland migration of these birds when on their way to their nesting grounds. I have often been in the line of their flight from the Puget Sound region to the valley of the Mackenzie River. Often they will rest at some deep water lake en route, flock after flock pouring in from high in the air until thousands are bedded down, every bird with its bill buried in the feathers of the back and actually fast asleep. They never feed under such conditions, but continue their flight a day or two later. Resuming their journey, flocks get up separately, usually just after sunset, and indulge in a sort of march, the separate flocks passing and repassing in all directions until at last, having acquired the requisite altitude, they all move off to the northeast in wavering lines high over the mountain tops.

The males return by the same route in small flocks often as early as the first week in July, the females and young following about three months later.

White-wings are the largest of the scoters. A big male will weigh as much as four and three-quarters pounds, the females a full pound less.

Surf Scoter

(Melanitta perspicillata)

The surf scoter is much the smallest of the three scoters. Its range is almost exactly the same as that of the white-winged scoter, the nesting range not quite so far south—extreme northern British Columbia, the northern section of the Prairie Provinces to James Bay and the Gulf of St. Lawrence (see Plate XIV).

It is outnumbered by its larger congener in all its winter resorts and is quite scarce in the interior lakes.

In actions and habits it is but little different from the white-wing, being the same low-flying, clumsy-rising duck. Its most striking characteristic is the deep whistling of the wings, which is made only when the bird is rising and again for a few strokes before alighting.

Of American ducks only the two species of golden-eyes, the present species and Steller's eider, make this musical noise with their wings, and it is pronounced only in the case of adult birds.

Surf scoters of all ages can be distinguished from all other ducks in life by their action when alighting. As the bird touches the water, the wings are extended upward and held so, as the body plows through the water to a standstill.

The eclipse present in nearly all northern ducks is absent in all the scoters. In the surf scoter the white patch on the nape of the neck is deciduous and falls out, leaving a smooth, black-feathered surface during the late summer months. Much care should be exercised in identifying the species of scoters by the white head markings, especially in the case of females and young birds.

The surf scoter can be called a large duck, males weighing as much as three pounds. Females are very much smaller and should be classed as medium in size, weighing about two pounds.

American Scoter

(Oidemia americana)

The range of this scoter is very northern in the breeding season, when it is found from eastern Siberia along the Arctic coast of America to Newfoundland. In winter it is found on both coasts and also on the Great Lakes (see Plate XIV).

My own experience with the American scoter is limited to the Pacific portion of its range, where I have found it to be absolutely and exclusively maritime, all the so-called records of the species from inland localities proving to be merely all-black specimens of the surf scoter, a common condition in the late summer.

In life the American scoter is an utterly different duck from the other two species. Like the harlequin, it loves the exposed rocky points and beaches, rarely seeking shelter even in exceptional weather. Also, like the harlequin, it is an active, restless duck, much given to rambling flights. In fine weather the males, often four or five to each female, pursue and surround the latter like a bodyguard. These flights are more common in fine, calm weather, when numbers of little parties may be seen turning

and twisting in the air, to return eventually to the starting point. The call of the male is musical, with a mournful and haunting cadence, and is uttered continually both on the wing and in the water, even sometimes when conditions are stormy.

Much has been written as to how to distinguish the scoters in life by the character of the white markings, but to anyone who knows the American scoter it stands out from the others by the carriage of the head when on the water. This is held high, as a rule, the bill always horizontal or even tipped up, never deflected downwards, as in the surf and white-winged scoters. On the wing the American scoter has a much finer flight, the underside of the flight feathers showing silvery in both sexes.

The American scoter is a large, heavy duck, males weighing three pounds or even more, the female about two and a half.

Hooded Merganser

(Lophodytes cucullatus)

This is another duck peculiar to North America, although, like some others, it has occurred as a straggler in Europe. The hooded merganser's range is a rather southerly one, as it nests in nearly all the States that provide it the requirements of hollow trees, north to northern British Columbia and the wooded portions of the Prairie Provinces, while in the East it does not nest north of southern Ontario and New Brunswick. In winter it may be found as far south as Mexico and north to southern British Columbia (see Plate XV).

Its range and requirements very closely parallel those of the wood duck, and, like that species, it loves the wooded ponds and winding, slow-running streams in preference to large bodies of water. Its safety must suffer from such an environment and its numbers certainly do show a decrease, but how much this is due to the clearing away of the timber along the streams it loves and to the decrease in nesting facilities it is hard to say. Certainly it is able to take care of itself under the most dangerous conditions, and very few adult birds, especially males, are shot.

The nest is in a hollow tree, usually very close to water, and the eggs are unique among those of American ducks, being very round, of an ivory-white color, with the shell very thick. The downy young are unlike those of any other duck.

The beautiful flattened crest of the male hooded merganser is only rarely displayed in all its beauty. When feeding it is folded down, and in flight there is never the slightest indication of it, the head being held straight out like a slender stick, while the small wings move with great rapidity, giving an appearance of speed even in excess of the really rapid rate that it achieves.

There is not much difference in the size of the sexes, and this merganser may be classed as a small duck of a little more than one pound in weight.

American Merganser

(Mergus merganser americanus)

This is the largest of the mergansers, or "sawbills," and it has a wide distribution in North America, from Alaska to Newfoundland in summer, and south in the mountains to California and New Mexico in winter, wherever open water and food conditions are to be found (see Plate XV).

A line of these handsome birds resting at the water's edge along some gravel bar is a beautiful sight. The sun reflected from the water on the deep cream of their breasts makes them glow like gold, showing off the coral red of their feet.

Just how much damage they may do to game fish is dependent on local conditions; where coarse fish abound, they do not bother trout much, and where bullheads are plentiful on the spawning beds of trout and salmon, the merganser is a positive benefit. But where trout and small salmon are the principal fish inhabiting a stream, the presence of sawbills is disastrous, as their voracity means the destruction of large numbers of fry and larger fish.

The American merganser usually nests in hollow trees, but where these are not available the nest may be under rocks or in cliffs. A pretty sight that I once saw was the spectacle of two females sitting on nests in clefts on opposite sides of a cave, their white chins showing above a mass of white down. The following season they were absent, as one of the clefts was occupied by a horned owl with one large youngster.

The American merganser is a very large-sized duck. The male will weigh four pounds, the female about half a pound less.

Red-Breasted Merganser

(Mergus serrator)

The red-breasted merganser has a more northern range than the other two sawbills,

Photograph by George Shiras, 3d

SURFACE-FEEDING DUCKS "STAND ON THEIR HEADS" FOR THEIR DINNER

To reach the succulent morsels of aquatic life on the bottom, the pintails, despite their long necks, have to "tip up," as do the mallards and black ducks feeding with them in the shallow waters of Currituck Sound, North Carolina (see Color Plates V and VII).

and it may be called an Arctic species, in summer breeding along the northern rim of both the Old and New Worlds and south in America to Michigan and Maine. I have never seen it nesting in southern British Columbia, many of the so-called records being the result of misidentification, but on the Queen Charlotte Islands and northward along the coast it gradually replaces the American merganser. In winter it reaches the southernmost States and Mexico (see Plate XV).

The red-breasted merganser is much more maritime than the larger species and at the proper season attends the spawning of the herring schools as its chief object in life. As soon as the wireless of the sea fowl tells of the spawning in some bay, all the mergansers are headed for that locality until thousands are congested above the doomed fish. To see the turmoil of sea birds on such occasions is to wonder that any of the herring or their eggs survive after the first onslaught.

Gulls generally are the first to locate the feast; mergansers are soon on the spot, followed by murres, guillemots, and three species of loons; grebes (Holboell's and western) and cormorants of several species are the last to arrive. To see the large loons arriving, flying straight and swift, low over the water and hurling themselves headforemost into the melee, causes one to wonder that birds as well as herring are not killed.

Females of the American and red-breasted mergansers are very much alike, but in the flesh are easily distinguished by their build and weight. The red-breasted merganser is a much smaller bird, being slender in shape. Males will weigh a little less than three pounds, females about two and a half pounds.

Fulvous Tree Duck

(Dendrocygna bicolor helva)

Tree ducks, usually known to gunners as "fiddler ducks," are long-legged and broad-winged, with a very erect carriage when standing (see Plate XVI).

The flight is unducklike, and their ample wings, dark both above and below in the present species, are moved slowly while their long legs trail behind.

The fulvous tree duck possesses the most extraordinary range of any species of bird,

being found in five widely separated "colonies": India, eastern Africa, including Madagascar, southeastern South America, northern South America, and northern Mexico to California and southeastern Texas.

In the last area, it is fairly common in the San Joaquin Valley, arriving early in April. The majority leave for the south before the duck-shooting season opens, in October. Stragglers have occurred as far north as British Columbia.

A medium-sized duck with rather goose-like habits, the fulvous tree duck is notable for the enormous numbers of eggs to be found in one of their nests, thirty or more, probably the product of several females. In California the nests are always on the ground, but in their more southern colonies they nest in hollow trees at times.

Tree ducks are of a retiring disposition and very nocturnal in their feeding. Often the only evidence of their presence is the whispering whistle of their cry as they pass overhead in the darkness.

Black-Bellied Tree Duck

(*Dendrocygna autumnalis autumnalis*)

The only region within the United States where this duck may be found is the coastal strip of the Gulf of Mexico, from Corpus Christi southward. It is more common in Mexico and has occurred as a straggler in Arizona and California (see Plate XVI).

The black-bellied tree duck is arboreal in its habits, perching freely, and its nest is always in the hollow of a tree.

There is a conspicuous white patch on the forward portion of the wing above, but the wing shows all black from below in flight.

Wood Duck

(Aix sponsa)

No duck has such an æsthetic appeal as the wood duck. The plumage of the male is usually described as "gorgeous," but this does not do justice to its combination of delicate vermiculations and bold slashes of white against a rich, dark background (see Plate XVI). And it is essentially and wholly an American duck, with no relatives save the still more strikingly garbed mandarin duck of Asia.

It is dispersed throughout the southern Canadian Provinces and all of the United States south into Mexico wherever the combination of water, woods, and hollow trees affords it a home.

A long period of protection throughout the United States and Canada has brought about a fine recovery from its former precarious state, and it is now a common bird wherever conditions are favorable. The essential requisite is a good supply of hollow trees in which it may nest.

In the valley of the lower Fraser River, flocks of a thousand birds or more have been seen in recent years, and I shall never forget a residence during the winter months at a point in the interior of California where winding sloughs bordered by oaks and willows afforded it both shelter and food. I knew that the wood duck was a loquacious bird for a duck, but had not expected anything like the chorus of squeals and clucks that reached me through my open window all night long! The birds were attracted by the acorns, many of them two inches long, with one end of exceeding sharpness, that were dropping into the water from the overhanging boughs.

These were swallowed whole, and it would be difficult to conceive of a more indigestible food.

In this same locality, Mr. Joseph Dixon made careful investigation of how the young reached the water from their hollow-tree nests. No evidence of their being carried or assisted by the mother was observed. They simply planed down by themselves, tiny wings and feet extended, in response to the call of the mother from the nearest water. The movement was so rapid that the camera could record only a little meteor-like blur.

Wood ducks in flight look somewhat like baldpates, the size and white lower surface being similar. The distinctive marks are the dark breast, wings, and tail, the latter being large for a duck, and, above all, the down-turned bill, not pointed forward as in a baldpate.

Bahama Duck

(Dafila bahamensis bahamensis)

Sometimes known as the "Bahama pintail," this duck owes its inclusion in our list to casual records in Florida and Wisconsin. It should occur more frequently, as it is common on the near-by islands that give it its name, as well as in most of the West Indian region (see Plate XVI).

The sexes are similar, and it gives the impression of sleekness and elegance, a graceful mover both on land and water. The tail has not the long central feathers of the pintail, but looks as if it had been whittled to a point from a piece of soft pine.

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SOUTHERN CALIFORNIA AT WORK

By Frederick Simpich

PEOPLE here say "water" about as often as Moslems say "Allah." Next to "money," they say it more than any other one word.

With water, work, and money, men are reshaping the destiny of this land, as did Nebuchadnezzar with the plains of Babylon.

More than 3,250,000 people live now in regions which were, until long after our Civil War, largely dry and empty. This mass movement of settlers, and the huge total of previously earned wealth they brought with them, are without parallel in the annals of migrations.

Cash spent by its visitors and the income that many residents enjoy from money earned somewhere else pay much of southern California's running expenses. You see why this is so when you stop to think that nearly a million people are lured here each year by soft, warm climate, and that over a long period an average of about one tenth of this annual army has settled here with its life savings.

From news, pictures, romantic railroad folders, their own visits here, and the talk of others who have made similar pleasure trips, many in the East think of southern California as a lotus land where life is easy. It *is*, for those who come to play, to rest, or just to enjoy laziness in a lush, subtropic climate. Yet the truth is that here, by the sweat of his brow and with infinite pains, man has turned what was a desert into that Eden which visitors see now as they ride over smooth paved roads through miles of fragrant orchards.

Outwardly, it all seems so complete; every trim green field, neat grove, and bright flower bed is in place, as the world might have looked after the six days of Creation. Yet man's work is never done. Behind the ease and glitter of lavish resort hotels, country-club life, and idle beach crowds of sun worshipers from the Middle West, the rhythm of pick and shovel, of daily routine in stores and factories, in oil fields and orchards, is constant and unbroken.

A SUPREME ENGINEERING EFFORT

Back of all this routine, in 1934 another task goes on, a stupendous, unprecedented effort. Its clatter echoes through long-silent canyons; empty deserts are dotted now with workmen's camps, and the shock of exploding dynamite rocks the hills as armies of men dig, drill, and blast, boring 91 miles of tunnels and excavating leagues of giant aqueducts to reach and tap the mad Colorado River and bring still more water to this ever-thirsting soil.

For 10 years experts figured, surveyed, drew maps, and planned, and for six years more thousands of men must toil, often stripped naked, in the stifling heat of tunnels shot through solid rock, to finish this gigantic undertaking.

This is southern California's supreme effort. It has never tried a task of such magnitude. In all the history of great waterworks, the whole world has seen nothing like it. These huge canals and reservoirs will be needed, the people say, to take care of growth in population, which has increased more than 1,400 per cent since 1890.

Los Angeles and 12 neighboring cities, forming the Metropolitan Water District, are building and paying for this vast water

Photograph by Clifton Adams

A MONUMENT TO THE SPANISH PRIEST WHO FOUNDED CALIFORNIA'S FIRST MISSION

At San Fernando Mission stands this memorial to Junípero Serra. One of the many missions scattered from Mexico City to the Golden Gate, this one also had its herds, farms, shops, and Indian vassals (page 584). Digging onions, a peon once found gold nuggets here, starting a mild gold rush.

system; but its safe, steady supply will depend on Boulder Dam, being erected by the Federal Government in the Black Canyon of the Colorado River at a point on the Arizona-Nevada frontier.

Boulder Dam itself will impound the world's largest artificial lake. Unreal, hard to believe—that here, in this dry waste of dust and mirage, there should suddenly appear a vast lake of cool, clear water, fringed by resorts and dotted with pleasure craft! About 125 miles downstream from Boulder Dam is another, known as the Parker; it is the diversion dam, where water will be taken off for use in southern California (see map, pages 534-5, and page 579).

Fly east from Los Angeles any week-end and look down on the highways that cross the deserts. Trains of scurrying motorcars raise league-long dust clouds, like Army wagons on the march.

"Where are they all going?" you ask the pilot.

"Out to see Boulder Dam. They go by thousands, month after month."

No wonder. Among river dams of all time it is incomparable. Set between the steep walls of a deep canyon, widening toward its top, the dam's towering bulk, as you look up, makes you think of one mountain tipped upside down between two others.

WORKERS GLIDE THROUGH THE AIR

Here the river bed is dry now, for the temperamental Colorado is routed around the dam site in diversion tunnels bored through solid rock, tunnels big enough to admit a Rhine steamer; or, fantastic thought, even for airplanes to fly through. The dam structure will be 1,200 feet across its top, and over this top will pass a highway, giving men and wheels their first chance in history to move directly between Arizona and Nevada.

Yet, massive as the dam is, its size is less amazing than the strange way they are building it. So much work is done from the air, overhead. Stand below the dam, in what used to be the bed of the Colorado, and look up. You see the air

Photograph from Andrew R. Boone

A DIZZY SWING OVER BLACK CANYON IN THIS "SKIP" AFFORDS A SPECTACULAR VIEW OF RISING BOULDER DAM

In these wood platforms with hand rails workmen are conveyed to and from their tasks. The large cables overhead are some of the many suspended from rim to rim of the giant gorge. On the far side is seen a narrow wooden stairway which leads down the canyon wall to an end of the dam (see text, opposite page, and illustration, page 537).

Photograph by Clifton Adams

HEAVY LOADS OF EXPRESS ARE HANDLED AT BURBANK'S UNITED AIRPORT

Large offices, built in Spanish style, and the spacious waiting rooms attest the activity of this aërial depot. Major western air lines converge at the place where, almost 100 years ago, the Mexican army yielded to Frémont.

Photograph from Universal

"INDIANS" REHEARSE A MOVIE ATTACK ON A PIONEER WAGON TRAIN

Such covered wagons brought hordes of early settlers to the West. Menaced by hostile Indians, firing as they rode, whites drew their wagons into a circle, when there was time to do so, and fought from behind the improvised rampart.

filled with men flying about like trapeze performers. They swing dizzily about on the ends of long cables dangling from aërial trucks that ride around the sky on fat steel ropes stretched from rim to rim of the vast abyss.

On the canyon rims are towers, to which these long steel ropes are anchored; and, to let the aërial trucks travel up and down the canyon as well as across and back, the towers themselves move along under their own power. This is so that men, tools, cement, and steel can be moved from the canyon rims and lowered at just the right spot where they are wanted on top of the rising dam.

"HIGH-SCALERS" CHIP LOOSE ROCK

Still more ropes hang down close to canyon walls, with a man seated in a boatswain's chair swinging on the lower end of each rope. These men are "high-scalers." Their task is to chip loose rock off the face of the cliffs. Among these were some 50 Apaches, picking away at lofty niches where even the cliff dwellers of former days would have felt giddy.

"Our high-scalers have worn out nearly 300 miles of rope," said Superintendent Frank Crowe, who represents the contractors and has built dams all over America.

"How do you pick dare-devils for that ticklish job?" I asked.

"We watch an applicant's face the first day he's ordered over the rim and down a rope. If he's nervous, we call him back."

Like high-scalers and other workers, we, too, wore the iron helmets issued to everybody here, to save heads from falling stones.

High above us, as we talked, came sailing a giant humming creature, for all the world like a 10-ton bumblebee, with two men riding on it. A flying concrete "agitator" it was, run by its own motor and stirring the cement inside to keep it liquid till the machine swung to the place where it was to be dumped.

"You call it a big bumblebee," said Mr. Crowe. "To me it's more like a mud dauber."

"What is your hardest problem here?" I asked the Superintendent.

Photograph by Clifton Adams

A STUDIO MAKE-UP ARTIST ADJUSTS AN ARTIFICIAL EYELASH

By the wizardry of make-up, as when young women are "aged," or sound men made into disfigured veterans for war films, an experienced artist can utterly change the character of a face by a few deft tricks, paint, imitation skin, and collodion (see text, page 577).

SOUTHERN CALIFORNIA ALONE IS TWICE THE AREA OF PORTUGAL;

In this southern half of the State appear the highest peak in the United States, Mount Whitney, and the River Aqueduct, which writhes toward Los Angeles, typify the part that hard work and water are playing in Angels" is world-famous Hollywood. Near the Mexican border lies San Diego, once a refitting place for

Drawn by A. E. Holdstock

LOS ANGELES IS LARGER THAN THE ISLAND OF MARTINIQUE

owest point in North America, near Bad Water, in Death Valley. Giant Boulder Dam and the Colorado caring for the rapid increase of population (see page 529). Only a dot on the sprawling "City of the Spanish galleons and now a base for the United States Navy.

Photograph by Clifton Adams

OLVERA STREET, LOS ANGELES, OFFERS THE ATMOSPHERE OF A MEXICAN MARKET PLACE

This short street near the old plaza of pioneer days strives for realistic fidelity. Sales girls and waitresses wear Mexican dress; shops display sombreros, pottery, blankets, and clay toys; men garbed as peons and town dandies play guitars and sing Mexican folk songs, as odors of chile con carne rise from sidewalk cafés.

"To keep our work in tune with the whims of this mad river," he answered.

Draining seven States, the Colorado is about 1,650 miles long, and may rise or fall with dramatic suddenness.

A NEW FRESH-WATER LAKE

The lake made when the dam is finished will cover some 227 square miles of land, and hold so much water that each person in the world could dip 5,000 gallons from it.

No water will run over the dam. Excess floods will be carried off through spillway tunnels. The rest, guided through other tunnels against the water wheels, will be ample to generate 1,835,000 horsepower, more power than any other hydroelectric plant has ever developed.

"Horsepower" is merely an engineer's phrase. It does not mean the measure of any horse's actual strength. Yet, in imagination, to sense the enormity of this plant, just think of a herd of 1,835,000 horses running forever through these tunnels!

Every day 330 carloads of cement and gravel go into the rising dam. When finished, the structure will contain enough material to build a fair-sized city, or to make a 60-foot paved highway from California to Chicago!

Left to cool naturally, it might take this mass more than a century to acquire a normal temperature, for freshly poured concrete is hot. And then it might crack or settle unevenly. To avoid this, and insure a solid structure, some 600 miles of one-inch water pipe are being built into the body of the dam, and through these, as work advances, ice water is steadily pumped.

For those with nerve to ride it, a giant "skip," a sort of airship swung on cables, flies about above the work. It can lift 170 tons. Hundreds of men daily ride to and from work in this skip, as in the basket of a great balloon (see page 531).

From the dam we went back at night to near-by Las Vegas, Nevada, to catch next morning's return plane for Los Angeles.

"We're the busiest town in America now. People pour in here from everywhere,"

Photograph by Clifton Adams

COLOSSAL BOULDER DAM RISES IN BLACK CANYON TO ENSLAVE THE TURBULENT COLORADO

Huge tunnels, invisible here, are bored through solid rock to carry surplus water around the dam; others shunt streams to power plants below. Men, with their trucks and workshops, make themselves at home in the now dry river bed below the dam which will rise to plug the gorge (page 531).

WILSHIRE (BOULEVARD) AND WESTERN (AVENUE) FORM THE BUSIEST CORNER OF LOS ANGELES

Some streets in the older parts of the city are narrow and congested; but, with wide avenues and fast bus and street-car lines to the many outlying towns now included in the corporate limits, an enormous movement of vehicles is handled with comparative ease and speed.

Photograph from Keystone-Underwood

GUASTI VINEYARDS ARE SYMBOLS OF ABUNDANCE

Astonishing to travelers is this vast sandy plain, near Los Angeles, on which grow veritable square miles of grapevines. "How can man make such fine grapes grow in that dry, white sand?" ask passengers on passing trains. "Work and water," says the conductor.

Photograph by Clifton Adams

AN EASTER SUNRISE SERVICE BRINGS THOUSANDS TO THE VAST HOLLYWOOD BOWL

This spectacular amphitheater is famed for its concerts, the "symphonies under the stars." Hollywood, municipally, is a part of Los Angeles, but it has its own lavish hotels, cafés, business center, and sumptuous homes.

Photograph by Clifton Adams

CROWDS ARRIVE IN A BLAZE OF LIGHT AND PUBLICITY FOR A HOLLYWOOD PREMIERE

Throngs pack the streets for blocks around on these gala nights. Stars and other distinguished visitors are announced through loudspeakers as they reach the brilliant entrance, and often a famous guest is coaxed to the "mike" to "say a few words." The "Chinese" name of the theater refers to the architecture.

Photograph by Spence

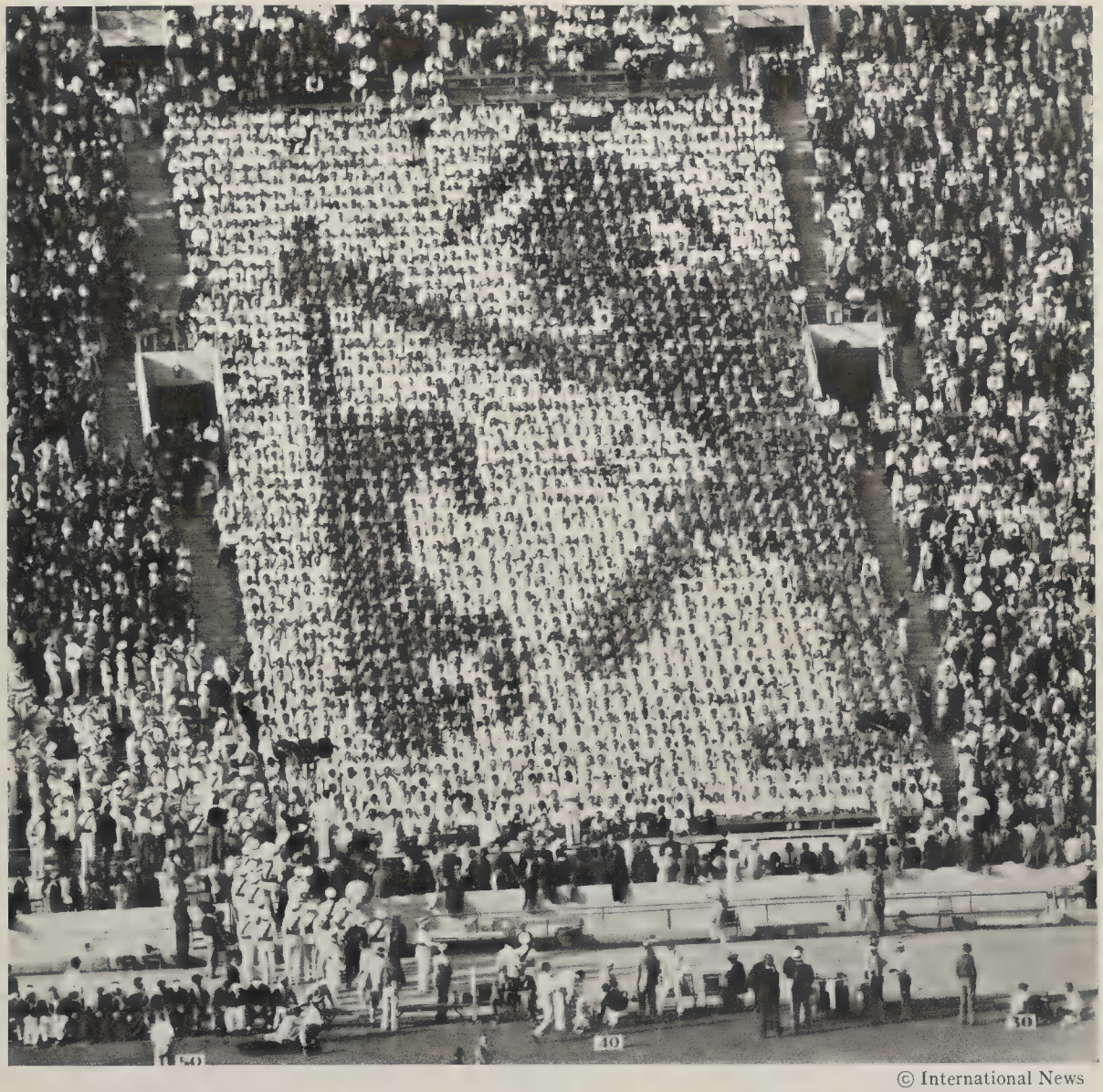
THE CURVING SAN PEDRO BREAKWATER, IN THE FOREGROUND, SHELTERS BUSY LOS ANGELES HARBOR

Naval vessels and others are anchored behind the breakwater. At the right center, seen as a white rectangle, is a 48-acre area whereon the United States Government plans to erect buildings for the Immigration and Public Health Services. This spot was once locally known as Dead Man's Island because many sailors were buried there about the time of the War with Mexico. Above this rectangle is Fish Harbor, where scores of fishing boats, some operating as far south as the Galápagos, are anchored. To the left is the San Pedro district; to the extreme right is part of the city of Long Beach. Round, white tanks of oil fields appear farther inland; beyond lies Los Angeles, and in the extreme background rise the San Gabriel Mountains (see illustration, page 556).

said an excited hotel keeper as we stepped among the prostrate forms of tired sight-seers from the dam. Some slept in lobby chairs, some on the stairways, others on temporary cots in hallways. That night 300 visitors could not find beds. Many huddled in parked cars or spent the night in gambling houses that line the main streets of Las Vegas. One such ornate hall is named "The Golden Camel."

My bedroom window looked down on a crowded gaming house, and all night long I heard the hoarse, owlish cries of the dealers. People were still playing at sunrise, when we left for the airport. Flying back, we looked down again on the long lines of cars. Many were returning now to Los Angeles. They had seen the dam, just as Egypt's sight-seers probably went out on holidays to watch Pharaoh's slaves piling up the Pyramids.

"Don't misjudge all these apparently idle men," warned a banker friend, as we walked through Pershing Square, Los Angeles, past



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IT TOOK 1,500 COLLEGIANS TO COMPOSE THIS PICTURE IN THE OLYMPIC STADIUM, LOS ANGELES

The rooters in darker clothes are arranged to portray a Trojan, representing the University of Southern California, holding the Washington State cougar by its tail.

rows of crowded benches. "This park is a kind of public forum. Some of this group I know by sight; they have snug deposits with us. Some are newcomers and will eventually get into business."

LOS ANGELES GREW FROM A MEXICAN VILLAGE

Sunning itself, reading the papers, whistling to half-tame quail that idle about the shrubbery, this park crowd, typical of other southern California cities, forms a sort of social clearinghouse. It includes the usual park pedants, who argue earnestly on every theme from war and taxes to labor laws and religion.

But most men, as you listen, seem to be telling where they came from back East, how long they've been here, and that it was mainly the fine climate that lured them. Still others read the Help Wanted columns. When you think that more than half of all the people in Los Angeles came here within the last six or eight years, you can see what a task of assimilation the city has faced.

Frenchmen say the story of Paris is the history of France. That is true of Los Angeles and southern California. The magic growth of the city, after almost a century of village stagnation, is closely related to the development of all southern

California. Between Santa Barbara and Bakersfield on the north and San Diego on the south are many other flourishing cities, with adjacent oil fields, orchards, farms, and ranches; yet all are dominated by a city greater than any west of Chicago.

About Los Angeles there is something unblurred and youthful—a certain exuberance and eagerness to be occupied that show through its pleasure-resort make-up.

It *is* young, as cities go. Settled about the time Washington and Lafayette were advancing on Cornwallis at Yorktown, it remained a dusty Mexican pueblo for more than another half century.

The gold rush of '49 passed it by. It was still a village when Lincoln freed the slaves, and as late as the 1870's many of its official documents were written in Spanish. It had a bad name in early days; people called it the world's wickedest place. One mayor resigned, temporarily, to help with a public lynching! In one wild night a mob hanged 18 Chinese, and preachers closed their churches in despair.

When nearly a hundred years old, the pueblo still had only about 7,000 people. Though American settlers multiplied, the place kept its frontier air, with its ox-carts, pack trains, family surreys, men on horseback, and stagecoaches carrying armed express guards. Bony steers and scraggly, half-wild sheep bawled and bleated through its dusty streets on their way to market.

At hitching racks the pine bars were gnawed by restless mustangs. Cockfights, bullfights, bear-baiting, and horse races amused the crowds, and 110 saloons quenched the thirst of mingled races.

IN LAND-BOOM DAYS

Then the railroads came, the Southern Pacific in 1876 and later the Santa Fe, and a rate war broke out. Round-trip tickets from Chicago or St. Louis sold for $15. At one time, in the eighties, such tickets sold for *only one dollar!*

Hectic, history-making land booms followed. Passengers gave away or burned their return tickets. Lots were sold and resold, often several times in one day. "Millionaires of a day went about sunning their teeth, with checkbooks in their outside pockets."

Veteran speculators, wise from experience in mob tactics with Iowa and Kansas land booms, came also. Some had cash to buy raw lands, subdivide, and sell to those who followed. "But, alas!" says one writer, "many were penniless or inexperienced, or out-and-out rapscallions. These did the mischief."

Against riffraff of this ilk the Los Angeles *Times* cried out that "dudes, loafers, paupers; those who expect to astonish the natives; those afraid to pull off their coats; cheap politicians and business scrubs are not wanted."

A WESTERN "CITY OF MAGNIFICENT DISTANCES"

But they came, anyway, and brass bands with flags flying led all and sundry to the slaughter. On one 36-mile stretch along the Santa Fe Railway 25 new "town sites" were sold to those who fought to buy.

By the end of 1888 the great boom, wildest the city ever knew, had blown over. It left Los Angeles with 50,000 people, a headache, but a good lesson. It got its breath, flocked to hear the evangelists Moody and Sankey, then started putting its house in order. In ten years it doubled its population, trebled it in the next decade, and to-day it shelters more than 1,200,000 people.

Sprawling over 450 square miles, it covers more ground than any other American city of equal population. It grew, in part, by devouring its neighbors.

Seeking a gateway to the sea, it annexed a shoestring of land 2,500 feet wide and 15 miles long, reaching south to Wilmington. Then it swallowed Wilmington and San Pedro and got its water front (see page 542).

It gives no sense of solid mass, like Philadelphia, as you fly over it; rather, a series of towns netted together by street-car lines and motor roads. Contrasts in architecture, from faded wooden houses with "bay windows" to ultra-modern, air-conditioned structures of classic beauty, emphasize its swift, haphazard growth.

Grotesque, indeed, are scores of startling, Coney Island-like buildings wherein food and drink are sold. Some are shaped and painted to represent giant owls, derby hats, shoes, airships, dogs, teakettles, windmills, mosques, wienerwursts, zeppelins, and igloos (see illustration, page 554). One café is built like a roundhouse, with a life-sized locomotive emerging from its front door. Another, the last word in realism, is a replica of a jail, bars and all!

© National Geographic Society Finlay Photograph by Clifton Adams

THE BLUE BOY—CLASSIC RESULT OF AN ARTISTS' ARGUMENT

Few paintings are better known than this vivid portrait now in the Huntington Gallery at San Marino. Gainsborough painted it after a discussion with Sir Joshua Reynolds, who contended that blue should not be massed in a picture.

HOME, IN SOUTHERN CALIFORNIA, EMBODIES SHADE AND FLOWERS

Tiled roofs, plastered walls, wide verandas, stone walks, and a jungle profusion of trees, plants, and shrubs are common. Hordes visit Riverside in winter. At the Inn a certain guest has registered annually for 50 years.

© National Geographic Society Finlay Photographs by Clifton Adams

ONE OF MANY SUMPTUOUS GARDENS ON MONTECITO'S SCENIC SLOPES

Overlooking the sea near Santa Barbara, the parks and gardens of luxurious mansions, enriched with pools, fountains, statuary, trees, and shrubbery, suggest Potsdam and Versailles.

"SHORTS" NOW, WHERE PIONEERS IN LEATHER BREECHES WRANGLED MUSTANGS

Palm Springs, a fashionable resort, stands in Coachella Valley, under the afternoon shadow of San Jacinto Peak. All winter long, adults and children ride bicycles, bask in the sunshine, and compare their deepening tans.

© National Geographic Society Finlay Photographs by Clifton Adams

REST AND PEACE IN THE ANCIENT PATIO OF SAN JUAN CAPISTRANO MISSION

Pioneer priests, struggling with pagans, laid this mellow mission's first stone in 1797. Though floods and earthquakes later smote it, the ruins persist as a symbol of the days of Spanish power.

© National Geographic Society

Finlay Photograph by Clifton Adams

LIKE A MODERN POMONA, THE GIRL AT THE TOP, QUEEN OF THE NATIONAL ORANGE SHOW, REIGNS OVER THIS TEMPLE OF FRUIT

To enjoy its county-fair spirit and sports—from side shows to throwing rings over canes and knives—huge crowds attend the orange show held at San Bernardino each February. Citrus fruits form this imposing display.

© National Geographic Society

HER ORANGE JUICE IS FRESH FROM THE TREE

Prices from year to year affect thousands of family fortunes throughout the citrus belts. Hence even children soon learn the fruit grower's language, for on prices may depend that new bicycle, or that trip east.

Finlay Photographs by Clifton Adams

THE CITRUS EMPIRE ENCIRCLES THE WORLD

On the big globe, made of oranges, our Western Hemisphere is mapped in darker-colored fruit. The golden spheres, set on racks in designs of birds, animals, houses, golf players, etc., are features of every show.

BULLWHACKING FOR THE CAMERA RECALLS THE GOLD RUSH DAYS OF '49

Hollywood is full of covered wagons, stages, ox yokes, saddles, guns, old Army uniforms, and similar relics, useful in recapturing the spirit of the West when it was wild.

© National Geographic Society

Finlay Photographs by Clifton Adams

SPECTACULAR ANEMONE FIELDS BLAZE WITH COLOR IN MARCH AND APRIL

Here at Carlsbad, in San Diego County, and around Los Angeles, the cut-flower industry flourishes. Orchids, gardenias, violets, sweet peas, and orange blossoms are shipped by airplane to New York.

CHINESE YOUTHS FLY KITES AMID WILD FLOWERS ON THE COAST NEAR SANTA BARBARA

The contrivance contains pointers for American boys. Look at the odd shape, the "bridle," and the tail of paper plates and cross-sticks.

© National Geographic Society

Finlay Photographs by Clifton Adams

MEXICANS EXHIBIT AT THE PASADENA GARDEN CLUB SHOW

Ignore straw hats, serapes, parrots, and the Villa effigy on horseback. Look only at abundant food, and think what cornucopias are filled by California's fertile fields!

© National Geographic Society Finlay Photograph by Clifton Adams

A FLEET OF PLANES LANDS ON THE 2½-ACRE DECK OF THE "LEXINGTON"

When this 888-foot naval aircraft carrier is under way, she "makes a wind over her flight deck," against which planes rise or land. An elevator, its platform outlined in the open space, lowers planes into a hangar in the hold, or lifts them when wanted.

Captive balloons hang in the sky, advertising this or that. Giant effigies of men, chickens, fish, and machines are also used. Stuck upright in the ground, far out in open fields, are huge red arrows, long as Pullman cars, advertising something else. Man's skill here in drawing attention to the city, or his own particular product, is truly astounding (Plate XI).

THE "FRIENDLY LETTER" CONTEST

Not long ago a leading newspaper induced thousands to write personal letters to acquaintances back East, painting the charms of Los Angeles. Prizes up to $1,000 were offered in this "Friendly Letter" contest, and pictures were published of all kinds of letter writers, from policemen to stenographers. One banker wrote 80 letters!

Men without work walk the streets here now, as everywhere else; and the city publishes warnings that no more job hunters are wanted.

Yet to a singular degree its immigration has been highly selective. Detroit grew swiftly, too, but that is more simple to understand. Men flocked there to get work at good wages in factories, and they made Detroit grow. But a million plus had settled here before the golden calf of industry was lifted up. Why did they all come?

Trite as it sounds, the answer is climate. "But we can't sell climate forever," says the city. "We've got to find something productive for these newcomers to do!" And that, exactly, is what happens; except that in most cases the settlers find it for themselves. Inevitably, when a million or more people settle together, they make business for each other.

Accept the fact, first, that it *is* the lure of a soft, languorous climate which, till now at least, brought most men here. "This place is air-conditioned," people say. "The sea breeze, the fog, and warm sunshine do it."

RISE OF NEW INDUSTRIES

To enjoy it, the rich come and build mansions, as at Pasadena. It lures farmers from the harsher climate of the Middle West, mechanics from Pittsburgh, and waiters from Milwaukee.

Each brings his savings. Some have enough to live on; some must add to income by labor here. Many of ample means soon get bored and look for something to do, for some local investment. The rise, in late years, of so many new industries is proof of this; for the capital is mostly local.

A proof of selective migration is the experience of one large tire factory. It easily found enough people, already here, with previous experience in rubber work, to fill its ranks.

It is so with other trades. "An 'ad' in the Sunday paper will get us any kind of trained worker we want," said a movie executive, "from taxidermists and trombone players to tightrope walkers."

Listen to the swarming sight-seers and you learn what interests them.

"How can we get out to see the warships?"

"I want to pick an orange myself and eat it."

"Let's go out to Hollywood and watch them make a movie."

Others would see the giant telescope on Mount Wilson, or the "Blue Boy" painting in the Huntington Galleries, or the sumptuous homes of movie stars in Beverly Hills. Many who are trade-minded, thinking of investment, make tours of the factory regions and the busy water front.

WHERE THE PEOPLE SEE THEIR NAVY

Out here on the west coast, tied by sea lanes with the Orient, you hear much about the "dawn of the Pacific Era," and a dozen reasons why so many warships are stationed in these waters.

Our Navy is close to civilian life here, notably at San Diego. Hosts of California women are married to men on the ships.

Last April, when 113 vessels with 35,000 men aboard sailed for a visit to the east coast, almost half as many Navy women and children packed up and crossed the States to meet husbands and fathers on the Atlantic seaboard.

When "the fleet is in," steady streams of visitors, largely from the Middle West, go out to see the ships.

No other section of our coasts so serves to keep the people, especially those from inland, informed about what the Navy is, its uses and needs, simply because so many inland visitors come here. San Pedro, Long Beach, and San Diego afford these points of instructive contact.

On its operating base at San Diego the Navy has spent millions for its air and training stations, its Marine Corps and

Photograph by Alexander Wiederseder

AN ARCHITECT'S ROADSIDE NIGHTMARE

Lunch stands and soft-drink parlors shaped like animals, fowls, jails, old hats, shoes, and similar odd objects astonish the newcomer as he rides about the suburbs of Los Angeles (see text, page 544).

destroyer bases, fuel and supply depots, radio and direction-finding stations, and an excellent hospital. This keeps thousands on shore duty, with huge sums spent on materials, supplies, food, and payroll.

Calm days and clear skies make these Pacific coast waters ideal for training. Target practice at sea, up to 90 miles away, sometimes breaks windows on shore.

Fleets of planes from both Army and Navy fields on North Island roar constantly over San Diego, the scene of many historic achievements in aviation. Here Glenn Curtiss flew a seaplane in 1911; Lincoln Beachey "looped the loop" here in 1913; our first experiment with aërial bombs was made here, and the first refueling trials. The city airport, western terminus of major air lines, is named "Lindbergh Field" because here was built the plane in which Colonel Lindbergh made that nonstop flight to Paris.

Some 165 planes flew 50 miles out to sea and landed on the two-and-a-half-acre deck of the carrier *Lexington*, from where I saw the fleet maneuvers of February last (see Color Plate VIII).

Steaming rapidly ahead (she can make 40 miles an hour), the 888-foot carrier "makes a wind over her deck" against which the planes land or take off, like ducklings from a mother's back. Dressed in asbestos from head to foot, a sailor, fire extinguisher in hand, and nicknamed "The Hot Papa," is always near by, "just in case." Yet nearly 20,000 plane landings have been made on this giant floating airfield without a fatality.*

When not parked on deck, planes are lowered by elevators into a hangar 500 feet long and 100 feet wide, the largest open space ever built into any ship. Here, too, "talkies" are shown at night.

SHIP IS LIKE A BUSY TOWN

To explore this carrier is like a trip through a small manufacturing city. She is at once a mobile fort and an airport, with a population of almost 2,000 people. It's a 190-foot climb from the engine room up one steep, slippery ladder after another to the gunnery officer's lofty control station, and, after my breath-taking struggle,

* The Navy has two such carriers, practically identical. The other is the *Saratoga*, known to sailors as "Sister Sarah" (see page 558).

Photograph from California Fruit Growers Exchange

EXPORTING FRUIT FROM BUSY LOS ANGELES-LONG BEACH HARBOR

Miraculously, in a few years, sea trade came to southern California when long-idle San Pedro mud flats were dredged and the present water front developed. In the four years following 1919 commerce multiplied 17 times. Besides fruit, much cotton and oil are exported and valuable cargoes of silk and crude rubber come in (see text, pages 559 and 593).

I can testify that it's no climb for a fat, swivel-chair sailor.

It takes 53 separate offices to direct the various activities on this ship, 23 shops, and dozens of other facilities you would also find in a busy town with ten times as many people. Besides hospitals, laboratories, and even a jail, there are separate shops for repairing radios, batteries, torpedoes, optical instruments, airplane wings and engines, instruments, guns, parachutes, etc., and also shops marked "Barber," "Baker," "Blacksmith," "Printer," "Tailor," "Cobbler," "Carpenter," "Painters," "Laundry," and many more. Here they publish both a weekly and a daily newspaper, and officers run a regular school preparing sailors for the Naval Academy.

"You've seen it all except my work," said the chaplain. And I went with him to choir practice. Too stormy that day for maneuvers, the ship rolled and wallowed and was full of those mysterious squeaks, groans, and slams from movable objects common to all big ships in rough weather.

We passed the barber shop, where "tonsorial artists" in green smocks powdered sailors' necks and sprayed them with fragrant pink fluids, and came to the choir room. One sailor played a small organ, and, as the ship gave an extra-long roll, the boys—quite unconscious, I am sure, of

© Karl Draxler

WASPS WITH FIREFLY LIGHTS DANCE AGAINST NIGHT SKIES BEYOND SAN PEDRO'S BREAKWATER

Seen as a dark line just below the United States Fleet at anchor, this sea wall is more than two miles long, about 200 feet wide on the bottom of the ocean, and about as high as a four-story building (see illustration, page 542). The shore lights at the left center are those of Long Beach, Alamitos Bay, Seal, Huntington, and Newport

Photograph by Edward W. Cochens

NOT OYSTERS ON THE HALF SHELL, BUT APRICOTS DRYING NEAR SANTA ANA

Orange County, whose chief city is Santa Ana, ranks among our Nation's most productive areas. Other than oil and oranges, its chief source of income is from beans, walnuts, berries, avocados, chili peppers, and sugar beets. Ample power, labor, and pure water, natural gas, four railways, and a short haul to Los Angeles harbor—all help this county earn normally about $90,000,000 of annual income.

© International News

LIKE A BIG FLOATING BIRDHOUSE, THE "SARATOGA" CARRIES HER MOBILE BROOD

Scout, combat, and bombing planes are seen aboard the Navy's carrier, as she makes ready at San Pedro for maneuvers. At the stern is the ramp, over which planes drift with motors cut, when returning to the ship to land on deck. The *Saratoga* is sister ship to the *Lexington* (page 554).

its peculiar appropriateness—began to sing, "Master, A Tempest Is Raging."

Day and night the huge ship is full of sounds strange to landlubbers, the sounds of insistent metallic voices calling for this or that officer, or broadcasting intelligence of general interest through 336 loudspeakers scattered about the boat. This shouting never ceases.

To stand on the wind-swept "flight deck" of this vast, rushing monster; to see planes go roaring over this deck and then jump off into space, one after another, only a few seconds apart; to watch them vanish in the upper clouds and then come diving down from 10,000 feet, in wild-goose formation; then to see the line flatten out, circle about the ship, and glide back on board, one at a time as wig-wagged on with a flag by day and neon light by night, is a never-to-be-forgotten experience.

Laughing girls in sailor suits, boat-club regattas, music, crowded liners docking, actors' yachts, gambling ships and police patrol boats, seaplanes taking off like flying sampans for Catalina, silk boats from Japan, tankers, tramps, freighters from the Seven Seas, a "mother ship" of Norwegian whalers with a brass band on board, the low gray shapes of American warships, their launches bringing bluejackets ashore—that is Los Angeles harbor. Protecting it all is a breakwater mightier than a section from the Great Wall of China, as you might see could you drain the salt water away (see page 542).

EMPTY MUD FLATS TURNED INTO A WORLD PORT

Yet Los Angeles has no sense of kinship with the sea, like Boston or Baltimore. Its sea trade has come so suddenly that those who fry hot dogs, pick oranges, sell autos, or work on the movie lots are not conscious of it. To them the Pacific is still just an ocean with sandy beaches to play on.

When Cabrillo ventured up this coast, some 50 years after Columbus discovered America, all he found were the mud flats, now dredged to make the Los Angeles-San Pedro harbor. For nearly 250 years hardly another sail was seen. Feeble reminders of that halcyon age of exploration are a few dirty, sullen old sailing craft, fat guns frowning from their portholes, used by movie crews playing pirate.

In "Two Years Before the Mast," Dana, visiting here in 1835, said the only structure on what is now the crowded San Pedro water front was an adobe shed where men from the cow ranches slept, and stored their hides and tallow, to meet Boston ships that came trading for these things.

Even the gold rush of '49, with the busy generation that followed and made San Francisco the largest city then west of St. Louis, had little effect on sea trade here, except to send a weekly steamer down from the Golden Gate. But this period set forces in motion that were in time to bring great changes. Wagon teams met the steamer, and freighted goods far across the deserts to mines in Arizona, even to Utah Mormon settlements. Railroads followed, with land booms and tidal waves of settlers. Though sea trade lagged, a slowly growing number of ships arrived, anchoring beyond the mud flats.

By 1912, when Los Angeles had acquired more water front and vast sums had been spent, she really began to get a modern harbor. Advent of the Panama Canal stimulated trade from coast to coast. The World War drew most shipping to the Atlantic, but in the four years following 1919 Los Angeles sea trade *multiplied 17 times*—a record unique in peace-time commerce.

This huge rise in cargo came from oil yields around Los Angeles. Lacking storage and refining facilities, there was nothing to do but pipe the oil out to the harbor and ship it as fast as vessels could carry it away. Sea lanes from San Pedro to Panama were crowded with tankers.

With the new harbor came more factories and assembling plants, and trade grew with the Orient. Cotton exports in December last were more than oil. Silk and crude rubber arrive in vast quantities.

Not a ship sailed from here direct to the Far East 15 years ago. Now 40 or more may sail in a month. In the last three years, Japan has built about 30 fast motor vessels, called "silk ships." They come from Yokohama to Los Angeles in 11 or 12 days; some go on to New York, a new silk route.

Ships of some 150 other lines now touch here, tying the port with nearly every part of the globe.

Overstuffed gulls, too lazy to earn their own living, crowd the harbor rocks, crying and fussing, waiting for the return of the fishing fleet, which chases everything from sardines to whales. You sense this after the olfactory ordeal of a walk past sheds wherein mysterious operations are performed on fish—to the delight of the greedy gulls.

Here again man's newfangled machines upset an old order.

Roving the seas as far south as the Galápagos, Japanese and Yugoslavs go after the schools of fish as relentlessly as hounds after rabbits.

Some boats use nets, but large tuna are caught in a peculiar way. Three men have each a pole, but all lines run to one hook, to give greater lifting power. Tuna often get so ravenous and excited that they strike at a hook bare of bait. The instant a tuna strikes, the men jerk it high and heave it on board. During a good "run," the three men may catch a fish every five seconds.

So many cans of fish are sold from here each season that no man could live long enough to count them.

MAKING A HOLLYWOOD MOVIE

When Hollywood had only 300 people and not even a "nickelodeon," pioneering actors rented an old barn there and began to film "The Squaw Man." Armed cowboys, dashing through dusty streets to "fight" Indians, alarmed the village.

If the play called for a scene on a front porch, the actors simply got permission to use somebody's porch. No one, at first, built special "sets." Such colossal structures as Babylonian palaces 300 feet high, built later to film "Intolerance," were undreamed of.

Now studios that are walled cities within themselves house this stupendous industry, whose strange feats smack almost of witchcraft (see illustration, page 561).

To make a "horror" picture, the illusion of prehistoric monsters invading a modern city was achieved with Texas armadillos. Shot at 20 times normal size, while

© W. E. Averrett

THE TREE-FRINGED MAIN AVENUE OF SAN DIEGO'S SPACIOUS BALBOA PARK

The 1,450-acre reservation is noted for its exotic plants and trees and for the grace and dignity of its architecture. First on the right is the County Fair Building; beyond is the American Legion War Memorial; the tower rises from the California Building. Here the Panama-California International Exposition was held in 1915-16, and here, in the World War, was a naval training station. Visitors to-day may wander through a fine arts gallery, Indian village, Montezuma gardens, natural history

ROMANCE, DRAMA, COMEDY, AND ADVENTURE FLOW IN MILES OF FILM FROM THIS HUGE FACTORY

The largest structures, like hangars, are sound studios, in each of which many different "sets" may be in use at once. In the background are "standing sets," or reproductions of forts, famous castles and churches, streets of foreign cities, villages from everywhere, heathen temples, etc. Other buildings include shops where scenery is made, warehouses for "props," dressing rooms for players, and executive offices (see text, page 559).

WHISTLER WOULD HAVE LIKED THIS VIEW OF SHIPS BATHED IN SAN PEDRO FOG

To study weather and its effect on men and their work, Los Angeles employs its own meteorologist. In about the same latitude as the south coast of Spain, the ocean off Los Angeles-San Pedro harbor has a variation in temperature of less than ten degrees throughout the year. Fogs or haze here, euphoniously called "velo" (Spanish for veil), hide the sky from sunset until about 10 o'clock the next morning. The maximum sunshine occurs in August and the least in May.

waddling past the toy buildings of a miniature city, the final effect on the screen was realistically hideous.

One studio has a toy shop where boats, airplanes, cities, railroad trains, and automobiles are all made in miniature. In "The Invisible Man," a tiny automobile, loaded with gasoline-soaked cotton and a fuse, was run off a toy cliff, bursting into flames. In the same picture a railroad train (with cars two feet long) tumbled down a mountain side. Both "accidents" were strangely convincing.

Coral and marine plants for undersea views are cleverly counterfeited. "When we found ocean stuff wouldn't transplant," said a Universal director, "we dipped cactus and other desert growth in a plaster solution. Dried and painted, this 'bottom of the sea' fooled everybody."

HOLLYWOOD AN ACTOR'S TOWER OF BABEL

Octopus tentacles and snakes may be merely a jointed tube, strung on piano wire, coated with sponge rubber, and painted.

But it is human beings and their behavior, as much as tricks with cameras, that make Hollywood, which is only a part of Los Angeles, better known abroad than the big city itself.

Since most of the world's movies are

Photograph by Keystone

LEMONS ENOUGH COME FROM PUENTE VALLEY, NEAR WHITTIER, TO MAKE A LAKE OF LEMONADE EVERY SEASON

Indigenous to India, lemons were introduced to south Europe by Arabs. By the time Columbus discovered America the Azores were shipping the fruit to London. Most American lemons, of the Eureka and Lisbon varieties, grow in five counties of southern California, the crop varying from 5,000,000 to 7,500,000 boxes. Lemon blossoms are sweetly scented, distinct from the fragrance of orange blossoms; also lemons are usually more profitable than oranges, since they keep better. Among by-products are citric acid, pectin, lemon oil, and lemon juice. A British law of 1867 required ships to issue lime or lemon juice as an antiscorbutic; hence the slang name of "lime-juicer" for British ships and sailors.

made hereabouts, the millions paid in salaries lure performers, real and would-be, from every clime. Besides stars and plain five-dollar-a-day "extras," these actors range from real pygmies, as in "Tarzan," to acrobats and bona fide bareback riders in plays like "Polly of the Circus."

Casting offices for years have studied hordes of people for different rôles. More than 17,000 are listed on cards for "bit" and "atmosphere" work. Every conceivable type is needed. As one official said, "We could not use the same crowd for an embassy reception as for a clandestine meeting of the Black Hand."

At the Metro-Goldwyn-Mayer studio, experts keep in mind the faces of some 7,000 semiregulars and use a filing system for thousands of extras.

"Eighty per cent of the types needed," I was informed, "fall into such groups as dress men, bellhops, police, collegians, butlers, riders, tall, short, and fat men, stunt

Photograph by Jacob Gayer

NOT A CABBAGE PATCH—JUST ONE OF DEATH VALLEY'S GRIM JOKES

Traversed by a motor highway up Death Valley, this odd surface formation—hard, hot, and dry—looks from a distance strangely like a vast vegetable garden. It is known locally as the "Devil's Golf Course" (see text, page 596).

men, army and navy men, tough men, judges, etc.; dress women (meaning intelligent, society types who can wear smart clothes), pretty girls, homely girls, stenographers, tall, short, fat, and stunt women, maids, character women, riders, dancers, dowagers, healthy children, peaked children, Hawaiians, Orientals, Latins, Nordic and Slavic types."

An emergency call for "one tough mechanic with a broken nose and two teeth missing" was quickly met.

ODD ASPECTS OF WORK IN THE MOVIES

Trained acrobats who can take rough falls and not get hurt; sailors with one eye; a distinguished-looking man with a continental-like "spade beard" who can work as a count or a diplomat—all these are in the cards!

"These bottles we break over each other's heads in barroom brawls couldn't hurt anybody," said an actor made up like Jesse James. "They're not glass; they're made of candy."

Some such trick candy costs $80 a pound. In the form of pills, it is used in shooting wintry scenes. The actor holds this pill in his mouth like a cough drop; as it melts, it gives off a vapor that is visible, like breath on a cold day.

Icicles of plaster, oatmeal for snow, and gales made by wind machines, all join to simulate winter. To make it rain over a three-acre field in "Little Women," RKO engineers built scaffolding high above the lot which carried a mile of perforated pipe. By this vast sprinkling system it could "shower" whenever directors yelled, "Start the rain!"

The area drenched represented the old home of Louisa M. Alcott, at Concord, Massachusetts, faithfully reproduced.

In another scene, horses hauled a sleigh across a "snow field" made of half-baked cornflakes. Being yellow, they photographed white. At the same time a battery of 20 huge motor propellers at one side of the field blew the air thick with cornflakes, making a "blizzard." During a pause in the work one horse got at a big bag of extra cornflakes, overate, was foundered,

Photograph from Wide World

A SIGHT THAT WOULD BEWILDER A SETTING HEN!

Hard-working chickens lay about 125,000 eggs a day at Runnymede Farms, near Los Angeles. A world record for egg output is claimed, as well as for volume of cackle sound effects, always reassuring to the poultryman. Daily delivery of fresh eggs is a marvel of modern distribution.

Photograph by H. A. Erickson

NEAPOLITAN IN ASPECT AND CLIMATE, SAN DIEGO USUALLY IS A CITY OF SERENE CALM

Good all-year flying weather, sunny skies, and calm seas make this region ideal for the Navy's maneuvers by water and air. Submarines lie in the right foreground and alongside a mother ship. Tall structures mark the city's business district, and, beyond, high mountains separate coast lands from the Imperial Valley.

Photograph by Clifton Adams

LONG BEACH'S PLEASURE CENTER OFTEN SEES THE U. S. PACIFIC FLEET ANCHORED JUST OFFSHORE

Rainbow Pier, two thirds of a mile long, open to both motorcars and pedestrians, encircles the Municipal Auditorium (left center) and encloses a 32-acre bathing lagoon. Before the auditorium, on made land, is an 8-acre tropical garden. There are numerous amusements of the Coney Island type, a roller coaster being visible just beyond the high-towered hotel.

and a movie veterinarian had to give first aid. Just then an actor, bundled up to face the "cold," got a sunstroke!

Among strange sights here is an Eskimo village with igloos, ice fields, and all. Five hundred men used tons of white plaster to make this set. It saves the cost of sending actors up north.

"FOREIGN COUNTRIES" SURROUND HOLLYWOOD

"Berlin" was only about 150 feet from "Mexico" on the Universal lot. "Rain" poured down in a Berlin street where actors in "Little Man, What Now?" walked along in raincoats, carrying umbrellas; cab horses pawed the water, and boys pedaled along on glistening-wet bicycles. From out in the dry a director called his orders.

For verisimilitude an exact model of a Berlin street car, all painted with bona fide names and numbers, clattered along under its own power. About a kiosk, or news stand, draped with illustrated German weeklies, a group of old German types recruited from Los Angeles lodging houses talked in German about German politics.

Barely a stone's throw away, on another "set," a cowboy actor, the idol of small boys the world over, was struggling through Mexican border brush a few jumps ahead of a Texas sheriff. He splashed out of a man-made swamp, over a property alligator tied by one leg, for a friendly chat, when he heard that a NATIONAL GEOGRAPHIC MAGAZINE man was present.

"In that last scene," he said, "where I had to cook and eat that chicken, I had a bad moment. I couldn't spoil the shot by taking the chicken out of my mouth. I had to go on and swallow it. But the trouble was a lot of hair from my false whiskers got stuck on the chicken and I had to eat it, whiskers and all!"

Any kind of scenery desired, from Alpine to Sahara, can be found or easily manufactured somewhere in southern California.

To film an Australian drama, some rolling plains were wanted like the terrain near Melbourne, where the principal action of the story took place. They were found in Los Angeles County.

"Sometimes, however, Nature plays a joke," said an actor. "Rain interrupted the shooting of some scenes where we used big leafless gum trees. Two weeks later, when we went back to complete that scene, the trees had leafed out. In order to match the old setting, we had to pick those trees like chickens, a two days' job for 20 men."

From snow scenes in mountains back of Hollywood to seaside set-ups is only a three hours' drive. "Covered Wagon" was filmed on a ranch near Burbank, now seldom used because two air lines fly over it and the roar of planes spoils sound effects (see illustration, page 532).

Near Santa Monica is an almost perfect bit of Cuba.

About Oxnard is a made-to-order Sahara. The "Alps" are in San Bernardino County, and the fishermen's village on the Los Angeles harbor has often been pictured as "Southern Italy."

I saw Universal filming one play with a scene using a bit of lake shore. During a halt in the acting, the "lake" almost ran dry; so a four-inch hose was dragged up and more water pumped into it. Trucks brought the right kind of trees and weeds about this "jungle lake," and men hurriedly set them out where wanted along the lake shore.

"We need some moss on that tree," said a technical man. And away sped a truck to a warehouse, coming back with the moss, artificial and painted, which was festooned over the tree limbs in realistic bayou style. They even dragged in an old log on which a fugitive from justice being hunted through the swamps could collapse from exhaustion.

STRANGE INSTRUMENTS OF ILLUSION

One company has its own hand-made jungle in which wild-animal scenes are filmed. Under jungle trees life nets are used in case of accidental falls by "wild" men and others who leap from tree to tree.

An odd order for one picture called for "5,000 moths and 200 cockroaches."

In "Stingaree," a tale of Australia in 1870, the background included bull carts, dingoes, and even a kookaburra bird, or "laughing jackass," all brought from Australia to give faithful local color.

The bird enacted his own comedy rôle by sitting in a tree and insulting the players with his raucous "raspberry" cry.

In making an American "talkie" of life in 1860, more than 6,000 separate items, with hoopskirts, ruffled pantalettes, bustles, wall paper, and top buggies of that period, had to be duplicated after painstaking

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JUST AN OLD SPANISH CUSTOM

With familiar ballads of long ago, sung by caballeros and señoritas amid the sweet scents of moonlit mission gardens, modern romantics seek to conjure up the spirit of cavalier days.

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Finlay Photograph by Clifton Adams

GIANT GREEN ROLLERS ROAR IN AT LAGUNA BEACH

Amphibian children of poets and preachers, of sculptors, writers, hotel clerks, and shopkeepers romp together in the brotherhood of the beaches. Laguna, with its art colony, lies on the coast road between Long Beach and San Diego.

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TWO LILIES THAT NEED NO PAINTING!

"Watch out for snakes," Victorian maidens might have cried. More aquatic moderns, eager to pick the flowers, find that cool water and soft mud feel good to bare feet.

Finlay Photographs by Clifton Adams

PLASTER-CHESTED ROOSTERS CROW OVER THE CLIMATE

These giant, red-crested figures are examples of the many animal effigies, teapots, machines, old shoes, and other odd objects set up along highways for advertising.

WHERE PALM CANYON LEADS DOWN INTO DRY, HOT COACHELLA VALLEY

The odd-looking trees wearing "petticoats," spectral by moonlight, stand far north for palms on this continent and may be a link with ancient days when seas lashed at these rocky foothills. This crooked crack in the world is explored by guests from near-by Palm Springs hotels (see Plate III).

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SPRING'S MAGIC PAINTS BROWN HILLS WITH BRILLIANT WILD-FLOWER COLORS

Motorists by thousands flock to hills, canyons, and deserts when poppies, lupines, sandverbenas, the thistle sage, monkeyflower, Indian paintbrush, and other wild flowers bloom.

MAKING READY FOR A RACE AT THE SAN PEDRO YACHT CLUB

On good sailing days, when waters are blue, skies clear, and breezes stiff, pleasure craft plow the southern California seas. Favorite courses are through the Santa Barbara Channel, or out to Coronado Islands. Some boats have raced to Honolulu.

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Finlay Photographs by Clifton Adams

THIS CAKE-EATING SWAN'S NECK IS AS LONG AS THE GIRL'S ARM

Each fall myriad wild geese, ducks, snipe, curlew, and others migrate down this coast. Instinctively they seek such havens as the Clark Bird Refuge, at Santa Barbara.

© National Geographic Society

DORÉ, WHO PICTURED DANTE'S INFERNO, SHOULD HAVE SEEN DEATH VALLEY

Deepest below-sea-level spot on our continent, unendurably blistering in summer, it is thronged in winter with visitors who ponder its diabolic

Finlay Photographs by Clifton Adams

THREE HOURS LATER, SOME OF THESE GIRLS SWAM IN THE SEA

To show diverse outdoor sports, they skied here at Big Pines, northeast of Los Angeles, in the morning, and enjoyed a plunge at Long Beach in

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MAKING MILLIONS LAUGH IS SERIOUS BUSINESS

Walt Disney, creator of Mickey Mouse, views his work. Quaint, capricious, and whimsical, his little creatures romp and chatter through animated cartoons and silly symphonies of comedy and grotesque adventure.

Finlay Photographs by Clifton Adams

A TOY-STORE PUPPETEER HUGS DANCING DOLLS

Behind the curtains of a tiny stage, with music playing, this young lady skillfully pulls the strings that arouse lifelike actions in her bright-faced Lilliputian company—to the noisy delight of young spectators.

WHERE FERNS CHOKE THE SHADY NOOKS OF SAN GABRIEL CANYON

An astonishing aspect of southern California travel is the swift passage from dry desert to verdant lands. A pleasant ride down a well-watered valley, fragrant with fruit and flowers, may end abruptly at the edge of dry, empty plains.

© National Geographic Society Finlay Photographs by Clifton Adams

"SAGO PALM" NUTS SHELTERED LIKE BIRDS' EGGS IN A NEST

Used only for seed for decorative trees in America, these nuts are eaten in some Asiatic lands. Cultivated in India and Malaysia, together with the more widely used true sago palm, the trunk yields starch, exported in dry, granulated form, which is used in puddings and for stiffening textiles. This *Cycas revoluta*, not a true palm, has feather-shaped fronds.

research. More than 4,000 people, drawn from almost every profession, craft, and trade in America, were employed before this picture was finished.

HOW SETS ARE MADE

Faultfinders in the audience protest and write derisive letters to studios if mistakes are made in scenery, costumes, weapons, etc. To avoid this means days of intensive study.

In making films with foreign settings, a "unit director" must see that all is true to life in that country. Every big studio has its research department, conducted by highly trained women, who aid the "unit" men. They answer questions like these:

"May women dine at a British officers' mess in India?"

"How do you address a duke?"

"What is the marriage ceremony in Annam?"

"What was the shape of the oar of a Roman galley?"

"May a woman marry a man on the eve of his execution?"

"How do women dress in the French prisons?"

"Did it rain in the wheatfields of Canada during September, 1902?"

One researcher, looking up the history of warming pans, found that in olden times, on chilly nights, slaves were made to lie in the cold beds for a time to warm them for the master!

From the research office the art director also gets his authentic pictures of houses, costumes, implements, utensils, etc.

In making one film which called for street scenes from the Mexican town of Tijuana, photographers were sent there to make working pictures. The fronts of skeleton houses later built on a Hollywood lot were exactly like the Mexican originals. When people who knew Tijuana saw that film, they would say, "Look, there is the curio store we were in," or, "Remember that perfumery shop?"

FINDING GOOD MOVIE PLOTS

In historic films research is imperative. In pictures made to represent life long before cameras, paintings and old books of descriptions are consulted. More than 600 books were read and scores of old paintings copied in preparation for filming "Ben Hur" and "King of Kings."

Studios have what they call "story hounds." These are trained readers who scour the earth for writers, new and old, into whose work is packed the humor, realism, and drama needed for the small compass of a picture.

" 'Grand Hotel' was first spotted in Germany," said a scenario writer, "under its original title, 'Menschen im Hotel.' An obscure Czechoslovakian magazine held the plot of another play. A woman in Italy, who had just seen a stage show, went straight to a cable office and sent a message which resulted in the purchase of the American film rights."

In one year M. G. M. studios alone read about 4,500 books, more than 3,000 plays, as well as hundreds of short stories from American and foreign magazines.

Novel and dramatic situations are at a premium. "I will trade you 100 gorgeous Hawaiian sunsets for one sock on the jaw" is a studio saying—a sock on the jaw meaning a dramatic situation.

MAKE-UP ARTISTS WORK MIRACLES

"It's easier to take a 20-year-old girl and make her look like 80 than it is to do the reverse," said one make-up artist; "but we *can* do both" (see page 533).

To play the part of a World War veteran who had lost an ear and been otherwise disfigured, one actor's face was so transformed by the skillful pasting down of one ear with fish skin and the use of collodion and fine cotton that his best friends failed to recognize him.

Wounds on the head of the Ape Man were made by pinching the skin together and painting the "scar."

Artificial eyelashes that cost $1 a pair are used by the thousands.

"Aging" is one of the most skillful tricks. Work begins on the neck, with shadows painted in and cords intensified. Lines are drawn at the corners of the eyes and mouth. Fat, or the lack of it, is shown by the use of red paint, and shadows under the eyes are made with bluish pigment.

Actors say Lon Chaney was greatest of all at make-up. It took him three hours to put on his crippled back for "The Hunchback of Notre Dame."

Movie influences on speech, manners, and dress, even on home furnishings, are obvious.

Films of American life shown abroad have definite effects on foreigners. Dance

MOUNT WILSON OBSERVATORY, HIGH ABOVE THE MISTS AND HAZE OF PASADENA

The dome of giant Hooker telescope, whose 100-inch mirror weighs four and a half tons, is seen in the lower right. The other dome, lower center, is that of the 60-inch instrument; the high tower, right center, is the solar telescope. Clockwork in the Hooker dome includes a 17-foot wheel which keeps the telescope pointed at moving stars. Increasingly bright lights of near-by cities, reflected in midnight skies, now interfere somewhat with observations (see text, page 580).

steps, slang, patterns of hats and gowns; even bathtub and swimming-pool designs have been exported. One Hindu merchant saw a certain style of floor lamp in an American film and wrote the studio again and again till they helped him get one like it.

Making a talkie calls for many different brains. An average of 117 trades and vocations is needed, even in smaller studios.

AMAZING ART TREASURES

Would you like to read the original of Ben Franklin's "Autobiography," done with a goose quill? Or a 44-page letter Washington wrote to Lord Loudoun, commanding British forces in America in 1756?

Or letters telling of Pizarro's conquest of Peru, and others, on many themes of former days, in the handwriting of Mary Queen of Scots, Henry VIII, and Sir Walter Raleigh?

All these, with some 800,000 other old manuscripts and dozens of famous libraries purchased *en bloc*, including 5,300 incunabula, or books printed before 1501, are now in the Huntington Library and Art Gallery at San Marino, which rises above the silver haze of San Gabriel Valley and overlooks Pasadena.

Photograph by Clifton Adams

BERDOO TUNNEL, IN THE COLORADO RIVER AQUEDUCT, IS 18 MILES LONG

Supplied by Parker Diversion Dam, 125 miles below Boulder Dam, in the Colorado River, this aqueduct will carry water over mountains and across valleys to Los Angeles and other cities of the Metropolitan Water District (see text, page 530).

San Marino Ranch was Henry E. Huntington's home. He gave it, with its stately buildings and the priceless libraries and art collections which they house, to the people of California. Now it is a Mecca for students from all over the world.

Visitors by the tens of thousands come to see its treasures, and to walk through its superb gardens, with never a "Keep off the grass" sign. Here are 207 acres of subtropical vegetation. In one arroyo are 25,000 specimens of cactus and succulents; palms from seven seas and gorgeous tree ferns remind you of old Garden of Eden wood-cuts.

But the rare *books!* A Gutenberg Bible, printed with movable type before America was discovered; Dante's "Divine Comedy," printed in 1472; Spenser's "Faerie Queene," 1590; "Hamlet," 1603; and tons of human records, from portolanos to private diaries, deeds dated in 1066, and, among more recent authors, the manuscripts of Pope, Shelley, Keats, Hardy, Swinburne, Rossetti, Lafcadio Hearn, Bret Harte; even Kipling's "Recessional" and Lincoln's scrapbook.

Astounding in their scope are the old writings about our own country; some by Columbus, Ferdinand and Isabella; later ones by Capt. John Smith, William Penn, and Governor Stuyvesant. Here are original Indian treaties signed by their "marks"; the only full list of men who took stock in the "Virginia Company," and the logs kept by some of the early ships which sailed to America.

CALIFORNIA CALLED AN ISLAND BY EARLY EXPLORER

How little men knew California in 1681 is shown in a letter from Father Kino, the famous Spanish explorer of our Southwest: "California . . . is . . . the fairest island in the world."

How our manners have changed, too! One old manuscript describes the burning of a priest named Lawrence. His legs were so sore from his heavy shackles that he had to be carried from his cell in a chair. But, out of kindness to him, his executioners let him remain seated while they laid the fagots and started his death fire!

Photograph by Putnam Studios

QUICK EYES AND DEFT FINGERS SORT A FLOWING OLIVE STREAM NEAR LOS ANGELES

First, all olives are passed through processing vats; then they move in a shallow stream through an automatic carrier, so that defective fruit may be removed.

Ignoring the rare books, many visitors come only to see the paintings and tapestries, the porcelains, chairs from the hand of Chippendale, or from salons graced by Marie Antoinette.

Of the British school of the 18th century, paintings here are mostly portraits—by Gainsborough, Romney, Sir Joshua Reynolds, and Raeburn.

Among others is that of Mrs. Siddons, the English actress, painted in her famous rôle, "The Tragic Muse," by Reynolds, and so often reproduced.

Toward me, viewing these portraits one day, came some other visitors. Ahead of this group strolled a tired, bored-looking girl of 10, halting to scratch one leg. Suddenly she straightened up, froze in her tracks, and gasped for breath. Before her hung the "Blue Boy," that never-to-be-forgotten lad in blue, painted by Gainsborough (see Color Plate I).

PHOTOGRAPHING THE STARS

If the earth were flat and the air clear, you could look through the 100-inch telescope on top of Mount Wilson, near Los Angeles, and recognize people you knew walking along the streets of New York; or you could point the telescope another way and read the names on ships passing through the Panama Canal; or watch brown girls dancing under South Sea palms.

When I ventured this fantasy on a certain cold night up on Mount Wilson, the astronomer barely grunted, for he was busy photographing a star.

Visitors climb the Mount Wilson trail by the thousands for a peep through its telescopes, or a look at the photographs which scientists are making of the stars and planets.

"How far is it to the stars? . . . How hot are they? . . . Are there any rocks on the moon like the pumice or limestone we have on earth?"

They ask the very questions that astronomers seek to answer.

Mount Wilson, a peak of the San Gabriel Mountains, 5,704 feet above the sea, rises above most of the seacoast haze and fog, and so makes ideal "seeing conditions" for large instruments. Observations can be made about 290 days each year.

Because it is easy to get up and down the nine-mile mountain road, except after snow or rock slides, the astronomers maintain their library, laboratory, and shops at Pasadena.

Fly over Mount Wilson and there, among the spruce, pines, and oaks, you see the gleaming white towers and domes which house the instruments of this Mount Wilson Observatory of the Carnegie Institution of Washington (page 578).

At one side is the famous Hooker reflecting telescope, most powerful instrument of its kind ever devised. Its mirror is 100 inches in diameter, 13 inches thick, and weighs four and a half tons. It took years to cast this giant piece of glass, to grind, polish, transport, and install it.

To-day the limits of the universe which man can see have been forced back by new powerful instruments till now from Mount Wilson he can look at nebulæ which are 140 million light years from the earth.

Photograph by Clifton Adams

PLEASURE SEEKERS BASK NOW IN WINTER SUNS OF LONG-DREADED DEATH VALLEY

Brooding, treacherous, shunned of old even by Indians, this region to-day is safe for travelers, thanks partly to motorcars and refrigeration. Its inferno aspects endure, yet to-day's visitors may sip iced drinks and scan long menu cards while looking out on wastes where men and women died of thirst in gold-rush days (see text, page 596).

In photographing some of these nebulæ, like the so-called Magellanic Clouds (as a mass of stars in the southern heavens is called), we use light that left them more than 100,000 years ago. So the picture shows these stars, not as they actually are now, but as they were a thousand centuries or more ago.

These photographs, then, as some one said, are made by "fossil light," and are as fossilized themselves as dinosaur eggs or mastodon bones.

It is not impossible, since the light which brings these images to Mount Wilson started so long ago, that by this time the original stars themselves may have dissolved and we get only a "ghost picture."

Think of it this way. Man's written records carry us back only about 6,000 years. Earth fossils show that life was in the world maybe 100,000,000 years ago; but it has taken light longer than that to traverse the limits of space.

Up on Mount Wilson astronomers ponder these things, slowly adding to our knowledge of Nature's laws. Yet in the shadows of the range farmers still kill pigs and plant potatoes in the right "light of the

Photograph by George E. Stone

SANTA MARIA VALLEY BEAN FIELDS SPRAWL FLAT AND FERTILE AS LANDS ALONG THE NILE

Some are so vast that "combines" and threshers are used at harvest time. Besides beans, this valley and adjoining lands, known as the "Santa Barbara County Salad Bowl," also grow commercially carrots, cauliflower, sugar beets, flowers, and grain. Cattle, too, are raised in this region.

Photograph by Clifton Adams

TINY PAPER TENTS SHADE YOUNG TOMATO PLANTS NEAR A SAN PEDRO OIL FIELD BRISTLING WITH DERRICKS (SEE TEXT, PAGE 599)

Photograph by Hetzel

ONE SEASON'S IMPERIAL VALLEY CARROT CROP, PULLED AND TIED IN BUNCHES BY MEXICANS, FILLED 789 RAILROAD CARS

moon," and say "money" three times when they see a falling star, so as to find some; and read "horoscopes" in the daily papers. What infinite superstition still attaches to the stars!

SPANISH PRIESTS THE FATHERS OF FARM LIFE

Talk with priests at the old missions and they will tell you that pioneer padres trained Indians to do the first irrigation work. Some of their old ditches still exist.

You can tell by where these missions stand what good judges of land the priests were. They never built a church on poor soil (see illustration, page 530).

Local farming owes these padres a great debt. They not only brought the first cattle and horses, but they experimented with seeds to see what would grow best here.

They planted the first oranges and grapes. Lemons, figs, and olives they brought, too, and wheat, destined to become a tremendous crop.

Almost feudal in aspect were these mission farms. Indians were trained as farmers, cowboys, carpenters, saddle makers, and weavers. They made things not only for the use of priests and themselves, but for Spanish soldiers as well.

Cattle became the mainstay of life, with beef the chief food; hides made leather for saddles, harness, and shoes, and even served as money. Early sea traders from New England called them "California bank notes."

Sheep, too, were raised; and Indians made blankets and cloth for suits from the wool. They raised some hogs also, mostly for lard to make soap.

Missions served as stock farms from which private owners could borrow enough breeding animals to build up their own herds. Horses of a tough, speedy type, with a strain of Arabian from those brought to Mexico by conquistadores, thrived here, multiplying so fast that in time wild herds became a nuisance. Men used to drive them into the sea to drown them.

Cattle often ran wild over the open range. In self-defense travelers sometimes had to shoot savage bulls. At slaughtering time, vaqueros rode down the thundering herds, slew what they wanted, and left carcasses to be skinned by butchers who followed. Melted tallow was packed in hides and transported to sailing vessels along the coast. This trade dwindled after gold was found.

"The inflowing of population made an end to the great droves of cattle," wrote Dana in 1859, on his second trip to California.

To-day this once huge industry, which kept the shoe and leather trades of New England supplied, is a dim tradition. In museums you see old oxcarts and horse gear, massive hand-made furniture and pioneer weapons.

Santa Barbara stages a fiesta here each season, where modern beaux and belles dress in pioneer Spanish costumes, ride horses with Spanish saddles, sing Spanish ballads, and dance fandangos to early Spanish music (see Color Plate IX).

But the modern spectacle is more splendid than the original hard, frugal life of toil ever was.

Practically all old ranches are cut up now. One or two, like the Santa Margarita and the Tejon, remain; but overseers make their rounds in motorcars. In fields where grunting oxen once pulled wooden plows, you hear now the staccato voice of gas tractors.

ORANGES SURPASS THE GOLD "CROP"

Among long-tailed, squawking macaws and tinkling bells in the Mission Inn garden at Riverside stands an old, old orange tree. It is one of two navel seedlings sent here from Brazil, by way of Washington, in 1873. Both lived and are ancestors now of countless trees whose fruit reaches not only the most obscure nooks of the United States, but goes to forty-odd ports overseas, even into Alaska by dog-sled delivery.

What a colossal feat of distribution!

Think of 100,000 carloads a year, cars riding an average of 2,600 miles each. Fantastically, you visualize this endless orange flight as a universe of tiny yellow planets flying forever out of California and into space! Orange picking never stops. Navels move from December to May and Valencias the rest of the year. With oranges go lemons and grapefruit, picked, packed, and shipped from some part of California every day in the year. Europe alone takes upward of a million boxes, and Canadians drink orange juice even as you and I.

To move and sell such incredible cargoes, more than 13,000 growers form the Fruit Exchange. Their salesmen are posted in 59 central markets, here and abroad. Their

ALMOND BLOSSOMS NOD TO DEEP SNOWS OF NEIGHBORING PEAKS NEAR BANNING

San Gorgonio Pass is Nature's portal for traffic between the Colorado Desert and the north. It was the ancient gateway for prehistoric peoples, then for Indians, Spaniards, and Mexicans. Now modern Americans are whisked through it by train, motor, and plane.

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IN THE FLOWER GARDEN OF AN ESTATE SOUTH OF LAGUNA BEACH

From the lookout tower unfold views of passing ships and Pacific sunsets. The yellow flowers are baby chrysanthemums; back of them, in red, are "red hot pokers," and in front of the girl is a bed of roses (see Color Plate X).

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Natural Color Photograph by Fred Payne Clatworthy

MEN HAVE DIED OF THIRST GAZING AT SNOW-CAPPED SAN JACINTO WITH ITS COOL BROOKS

On the low sand dunes to the right is the scraggly mesquite bush, much of it being slowly covered by drifting sand. The root is dug for fuel and the beans are eaten by cattle. The abundant purple flowers are desert verbenas.

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Natural Color Photograph by Fred Payne Clatworthy

"SEVEN PALMS" IS NOT A TOWN, BUT THE LOCAL NAME OF THIS DESERT SPOT IN COACHELLA VALLEY

San Jacinto Peak, rising about two miles high in the background, is reached by a five-mile trail. Palm Springs, elevation 455 feet, is slightly to the left, and not visible here (see Plate III). The gray streak in the background is a dry, sandy wash.

AFTER SPRING RAINS NATURE STREWS COACHELLA DESERT WITH FLOWERS

Desert verbenas and the evening-primrose predominate. The yellow blossom in the foreground is a wild sunflower. At the upper right is a young date palm, and beyond it are creosotebushes (see Plate XIX).

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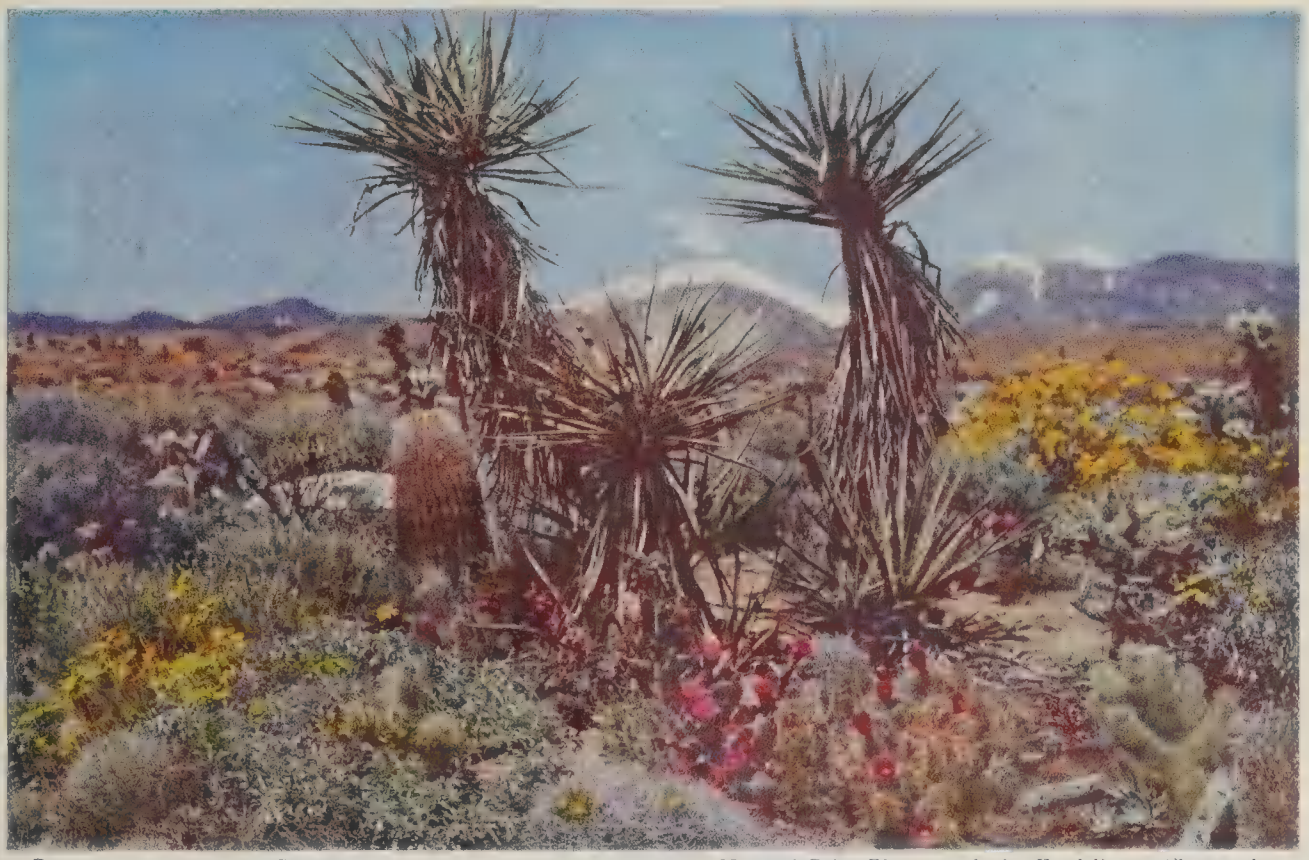
YELLOW GENISTAS BANKED IN SOLID COLOR AT HIGHLAND SPRINGS

Of Old World origin, this cultivated spring shrub is seen growing a few miles northeast of Beaumont, at the site of one of the oldest stagecoach stations on the east-west emigrant route through San Gorgonio Pass (see Plate XVII).

TILE-ROOFED VILLAS DOT THE COAST ABOUT SAN CLEMENTE

The sea fig (or figmarigold) blooms profusely here, after spring rains. From Santa Monica south, the motor highway leads past many cities, towns, and seaside resorts, which are suggestive of Mediterranean lands.



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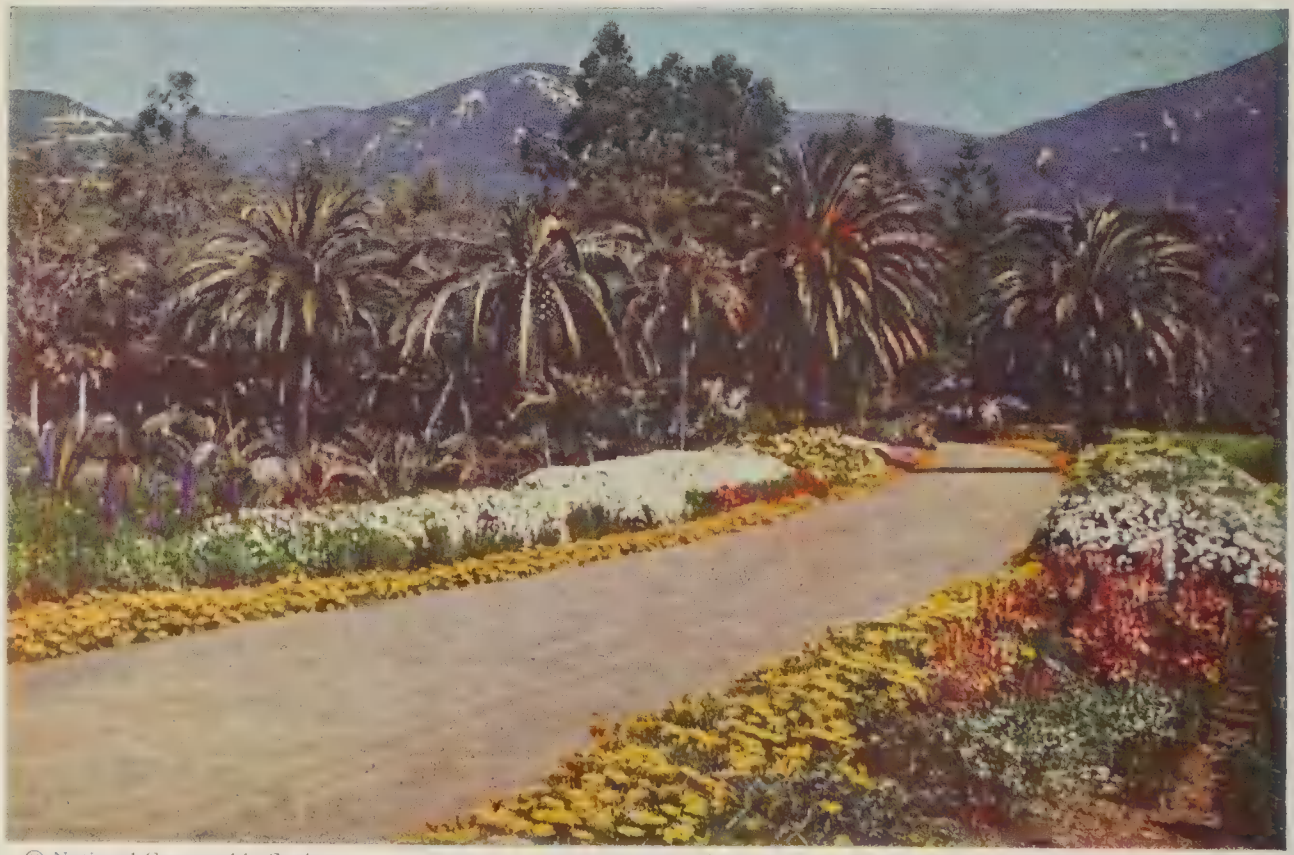
A "DEVIL'S GARDEN" OF CACTUS FRAMES SAN GORGONIO MOUNTAIN

Located about 25 miles northwest of Palm Springs, these plants include: left center, bisnaga, or barrel cactus, which yields water; pink blossoms in foreground, fanleaf cactus; lower right, the cholla, which, Indians say, is so vicious it jumps at you.

OFTEN BRILLIANT DESERT FLOWER FIELDS ARE VISIBLE 15 OR 20 MILES AWAY

This mass of poppies, lupines, and other blooms was photographed near Arvin, southeast of Bakersfield, where an annual wild-flower show draws huge crowds. One hundred and eight varieties are known here, the purple lupine alone sometimes covering about 3,000 acres.



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FRAGRANT FLOWER BEDS RIM THE SMOOTH ROADS THAT WIND THROUGH MONTECITO ESTATES

Luxurious suburb of Santa Barbara, winter home of many easterners, the "Little Forest" of the Spaniards is now noted for the spacious lawns, fine old trees, and landscaped gardens that slope down to the sea (see Color Plate II).

PAINTED CANYON, NEAR THE NORTH END OF SALTON SEA, IS ALMOST AT SEA LEVEL

Mecca, a small town near by, is 189 feet below sea level. *Submarine News*, once printed hereabouts, was known as the world's "lowest down" paper. The new routing of a transcontinental highway passes near, crossing the Colorado River at Blythe.

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CACTUS, WITH SHARP CLAWS, WICKED THORNS, AND DAGGERS, IS SYMBOLIC OF THE MENACING DESERT

Ocotillo, the tall slim bush in the background, is used by Mexicans for making corral and chicken fences. In the foreground are the familiar cholla—whose spines will penetrate thin shoes—and the bisnaga, or barrel cactus (see Color Plate XXI).

ADMIRING VISITORS WADE WAIST-DEEP IN DESERT SUNSHINE FLOWERS

Southwest of Indio, below the foothills of the Santa Rosa Mountains, these spring blossoms cover vast stretches of desert wasteland. The flower heads are nearly two inches in diameter.

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FEATHERY BLOSSOMS OF THE CUSHION CACTUS, ORCHIDLIKE IN DELICACY

Blooming on an evil-looking plant of Southwest deserts, this variety, like the beavertail, deerhorn, pancake, and grizzly bear, is named for its resemblance to a familiar thing.

"Sunkist" brand stamped on fruit is known around the world. They even own their own timber lands and sawmills, where millions of crates are made for packing fruit. By-products, like orange and lemon oils, citric acid and citrus pectin, are made and sold by this organization.

Ships that carry its fruit abroad are vast floating refrigerators, for they must pass through the Panama Canal and other tropic waters (see illustration, page 555).

Frost is fought with oil-burning orchard heaters, while millions are spent on sprays and fumigation.

Individual growers, competing, could not have obtained such methodical, world-wide distribution of oranges now graded, inspected, and sold by the Exchange. It is conspicuous among all man's cooperative efforts. Common interests unite its members, both in business and social affairs.

One visit to an annual orange festival, with all its music, drama, pageantry, and carnival spirit, shows what a big rôle this fruit plays in California life (see Color Plates IV and V).

More than any other one force, it was the lure of life in a sunny California orange grove which started easterners migrating here in the 1880's—and it still brings them.

From its trees, since the Exchange started its records in 1894, have been picked and sold nearly two billion dollars' worth of citrus fruit—or more than the value of all gold mined since its discovery in 1848!

THE RISE OF THE VEGETABLE TRADE

The Bible story of the miraculous gourd vine that grew in one day to make shade for Jonah is hardly more astonishing than the rise of the western vegetable trade. It is an exciting page in the annals of our national farm life. New food habits, the call for more green things, is one cause. Advent of the iced car, overcoming California's former disadvantage of remoteness from eastern markets, is another.

Due to geographic barriers, as late as 1900 this trade was a mere trickle. Now, with refrigeration, standard packing, and advertising, more than 100,000 carloads of garden truck, largely grown in California, ride east every year.

Fly over our Southwest in winter and see the miles of empty yellow cars parked on every available switch and sidetrack as far east as New Mexico. Railroads assemble them there, ready for the seasonal rush of lettuce, peas, cantaloupes, cauliflower, celery, and other fruits and vegetables—enough cars to have moved all the American soldiers who took part in the World War!

Imperial Valley, that below-the-sea "Hothouse of America" once called the Salton Sink, grows more cantaloupes, honeydews, and casabas than any area its size in the world. Its large-scale operations are indeed "industrialized farming."

Terrific heat, dust, and the frantic picking, packing, loading, and icing of more than 6,000,000 crates of melons in a few weeks turn this valley, from May to June, into an inferno of nervous haste.

Only Mexicans and Japanese seem able to work in the sun-scorched fields; some say that only they can tell just when a melon *should* be picked, or when a mule will surely drop from being overheated if driven another rod. Yet 60,000 residents endure this climate!

Frost-free regions along the San Diego coast send their share of tomatoes, celery, and other green foods. Los Angeles County was the pioneer garden spot; here first grew that lettuce now called "iceberg head," an Italian strain introduced through Vilmorin, famous seedsman of Paris.

Something grows in some garden here the year around. Even Nature can be fooled in this high-speed gardening. The artichoke, for example, normally fruits in summer, in the fog-infested coastal valleys. But the growers, by cutting back the plants in June, force them to bud in winter!

Despite its amazing volume, this trade has its problems, one of which is to make a profit. "Some new, puzzling trouble is always coming up," said a grower. "One of them is how to lick the bugs . . . *they* never lose."

ELECTRICITY DOES THE WORK OF MILLIONS OF SLAVES

You marvel at miles of power lines carried on steel towers. Hardly a country home is without electricity. Farmers throw a switch and machines cook food, heat water, milk cows, sterilize milk, and separate the cream. Electric power hatches eggs and warms the coops. Long, dry summers call for much pumping, and electric irrigation pumps run almost continuously from April to September.

Walnuts, formerly dried in the sun, are dehydrated now by electricity. To make

Photograph by Clifton Adams

A STARTLING FOREST OF OIL DERRICKS RISES ON SIGNAL HILL ABOVE RESIDENCE STREETS OF LONG BEACH

Photograph by Hetzel

STRIKES IN 1934 DELAYED PICKING THE IMPERIAL VALLEY CANTALOUPE CROP, WHICH EXCEEDS 7,500 CARLOADS ANNUALLY

Photograph by Gabriel Moulin

ACRES OF CHRYSANTHEMUMS AWAIT CUTTING FOR THE MARKET

Japanese rank first as growers of outdoor flowers in southern California, though with hothouse crops Americans and north Europeans are most successful. Some 200 gardeners cultivate about 1,500 acres of flower beds. Parent plants are often imported, some few from the Tropics. For a prize orchid parent as much as $500 has been paid. Southern California also abounds in amateur gardeners.

seeds germinate faster, cables laid in the soil are heated by this power.

With electricity oranges are colored and precooled for shipment.

Motors hum in myriad industries. In busy oil fields, shops, and harbor sheds, bright lights turn night into day. With electricity men drill for oil, pump it when natural flow subsides, and refine it. The same power heats enormous furnaces and annealing ovens.

Here electricity spurred imagination long before the rest of the world appreciated its versatility. The reason is that California, when most of the present electric systems started in the 1890's, had no native fuel except wood. Coal, transported from far places, was costly; but in the mountains was abundant water power. The market for electric light was small in pioneer times and few industries had then started; but the farmer was here, and entrepreneurs taught him to use power for irrigation as early as 1893. Now power lines cover this map like a web.

Where formerly the only source of energy was mountain water power, about half the current is now made from steam power generated by natural gas as fuel. This gas is piped down some 200 miles from the Kettleman Hills, which lie in the Coast Ranges, on the west side of San Joaquin Valley.

Here you see how the wide use of electricity can raise the standards of life and reduce physical toil.

ONCE DREAD DESERT IS NOW A PLAYGROUND

News that the Thirteen Colonies had become the United States didn't reach Pacific coast Spaniards till years later. Barriers of distance and desert were such that even after California joined the Union, in 1850, it still took weeks to get mail from Washington. No other State was ever so isolated.

Men hated the desert then and feared the horrors of death from thirst. Every trail across it was strewn with bones of men and oxen and abandoned wagons.

Now the desert is man's playground.

Planes, trains, and motors, of course, have robbed the desert of its dreads. Now idlers in shorts, bright-colored pajamas, or bathing suits sprawl about these desert pleasure resorts, as in Death Valley, and fret if they can't get this or that favorite brand of imported mineral water, all within a stone's throw of where dying pioneers found not even a mouthful of alkali water!

The sting has been taken out of Death Valley completely by modern transport. Much of it is now a National Monument, and winter visitors swarm in over new roads, lured by its astounding physical geography (see page 581 and Plate XIV).

You can imagine that here a giant smashed the world to bits, baked it, then spilt seas of paint over the colossal, silent ruin. Nature's emotions range from utmost fury to moods of restful calm (see p. 564).

Stand on Dante's View, a peak in the Black Mountains which towers high above the floor of Death Valley, and you can see over more than 150 miles of this weird, incomparable region.

Far to the west is Mount Whitney, highest peak in the United States, and below you is the lowest point in North America, 276 feet below sea level. And up the valley floor there stretches what looks like vast alkali swamps; but that is an illusion, for it is merely a coloring of the desert.

"Do you live here all alone?" I asked an old man who sat before an empty hotel in the historic ghost town of Ryan.

"Me and a chipmunk," he said. "My friend'll be out soon and you can see him. He always comes to eat at 10 o'clock." And at 10 he came!

Borax and a few other minerals first made Death Valley a busy place. It was then that the famous 20-mule teams hauled the big freight wagons with a water-tank trailer, taking weeks on the long, rough round trip out to a railroad station on the Mojave Desert.

Mining is abandoned now. The borax diggers found a richer, more convenient deposit near Kramer, on the Mojave Desert, where they can bring up huge chunks of glistening, glassy borax, with a railway close at hand. So the long mule trains are no more; but you can still see the giant wagons standing along Furnace Creek Wash, where the tired, dusty mules were last unhitched. Beside these big wagons visitors pose now to be photographed. That is commonplace reality; all about is unreality, illusion.

Sometimes this illusion is almost convincing. Moving dust, changing lights and shadows, enrich the strange, infernal region with infinite fantastic shapes and patterns; castles, streams, and lakes, even waterfalls,

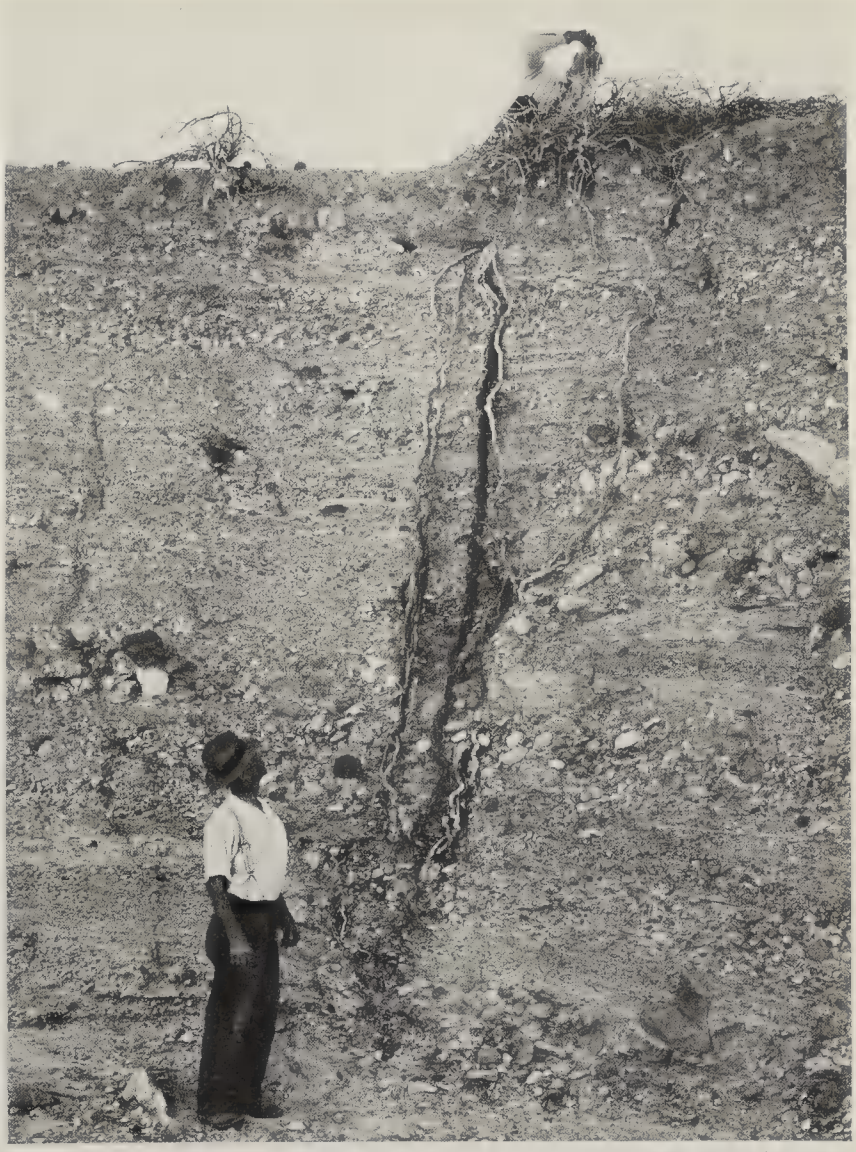
you think you see them all. Mirages recur. When motorcars, raising a dust, approach through a distant, low-hanging mirage, the illusion is that of a speedboat kicking up a spray of water.

Save one or two tiny favored spots where water comes down from the canyons, Death Valley knows no cultivation. Despite sightseeing busses and private motorcars that throng its dusty trails, there is still something very significant in the warning signboards which tell how many miles it is to the next water.

Different, indeed, its destiny seems from that of other California deserts crisscrossed by man's irrigation ditches!

Maps of barely 30 years ago bore the words "Colorado Desert" across what is now Imperial County, with 60,000 people.

If the prehistoric monsters who left their tracks about the Salton Sea could come back, they would find plenty to eat now, for this below-the-sea region has become the Nation's hothouse.



Photograph by Jacob Gayer

ON DESERTS EVEN PLANTS MUST DIG FAR FOR WATER

Judging by the man's height, the root of this forage plant, known as saltbush, must descend at least 15 or 18 feet; greasewood and alfalfa do likewise, in lands of low water tables. This steep bank of a dry wash in Death Valley reveals how soil, gravel, and rocks have been washed down from mountain sides and deposited in deep layers.

Years ago a plant explorer for the United States Department of Agriculture brought some date suckers from Arabia, which were planted, experimentally, at Indio, in the Coachella Valley.

To-day a huge industry has grown up and the groves there resemble those about Baghdad or Basra, in Iraq.

Much of the desert basin above the Salton Sea, with its duck clubs and speedboat races, is still empty; here and there are date and other gardens of astounding fertility. Men must have felt the heat the day they gave such local place names as "Mecca," "Arabia," "Thermal," and "Biskra."

Planes from Los Angeles for Phoenix, Tucson, and El Paso fly down this long, hot valley, entering from the north through San Gorgonio Pass (see Plates XVII and XXI).

Often winds here attain great violence. Guests from Palm Springs told of watching a flock of north-bound wild geese, frustrated by a gale that blew south through this pass. In vain the birds bucked this head wind. First one gander and then another tried to lead the wind-tossed flock, only to fail. Finally all the geese turned in disorder and flew back towards the Salton Sea.

Photograph from U. S. Marine Corps

TRUMPETERS OF THE GUARD AT SAN DIEGO MARINE BASE SOUND "TO THE COLORS!"

The four men faced troops (in formation behind the camera) and called them to attention, as the colors left the sally port. The shield above the port is the insignia of the Marine Corps. In the background is the gymnasium.

Grotesque tumbleweed, rolling over deserts in hard winds, looks like brown bears at full gallop. "No; it's more like tarantulas than bears," insisted my driver.

Not far from San Gorgonio Pass, we visited one of many construction camps on the Colorado River Aqueduct project and walked miles into the long Whitewater Tunnels. A worker there had found a petrified egg about the size of a coconut.

Across the valley another gang was digging the great hole that will carry water under the San Jacinto Mountains (Plates XVIII and XIX). Like the Indians before them, local whites say that sometimes this mountain "growls." Geologists say it is a "young" mountain; that if there are growls, they may be earth tones from subterranean movements along earthquake faults.

Earthquakes occur here when one block of earth crust slips past another along an earth fracture. Several such faults extend from the Mojave Desert to offshore islands.

One such slip caused the Long Beach earthquake of March 10, 1933. Mud and hot water squirted from cracks that opened in the ground. Many people say they saw a waving motion pass across the fields which set trees, houses, and water tanks to swaying, while up from the rocking earth came a deep-toned, roaring sound.

Most significant to southern California is this fact: After the quake all former "hush-hush" policy was abandoned by newspapers and trade groups, and the California Institute of Technology was asked to study the menace and to suggest plans for reducing loss of life and property damage in future quakes.

If a giant could seize the edge of this region, as you might grab the lid of a steamer trunk, and thus lift the top off southern California, you would see below it one of Nature's busiest workshops. Down here, in the dark, things go on which affect all that live up above in the sunshine.

Far into the earth, miles and miles deep and many leagues long, run the faults or fractures that figure in the quakes; but more important to man on top of the ground are the vast underground basins that hold water for his wells and other great natural tanks, from which for decades he has pumped that oil which, more than anything else, has put this region on a solid economic basis (see page 583).

Since exciting early days, when pioneers bored and found oil in commercial quantities within the city limits of Los Angeles, its flow has increased, and southern California has become a financial and geographic center of a Titan industry.

Many pioneer Los Angeles wells have vanished, although here and there a veteran survives, its black elbow "silently pumping a living for its owner." Even the sites of some wells that made their owners rich are forgotten now, or covered again with grass, flowers, or perhaps with a roadside soft-drink stand shaped like a kangaroo or an old shoe.

Historic, indeed, are the La Brea pits, beside what is now Wilshire Boulevard; their foul, greasy pools were once found clogged with the bones of prehistoric animals. And there is Long Beach, still an active producing field, but where, in the days of discovery, ugly derricks rose overnight like magic forests to clutter the back yard and quiet streets of astonished residents living near Signal Hill (see page 594).

As with the land booms, so in the days of oil excitement there came hordes of oil executives, technicians, drillers, rotary helpers, derrick men, tool-dressers, teamsters and truckmen, roustabouts, pipe liners, tank builders, refinery workers, and stock salesmen, adding their thousands to an already heterogeneous population in and around Los Angeles, the fields of Kern County, and the Kettleman Hills. One well in Kettleman Hills was bored in 1933 to a depth of 10,944 feet, a new record.

PUMPING OIL FROM THE SEA

Odd, indeed, to visitors is the sight of oil derricks set out in the ocean, down the coast from Santa Barbara, which pump oil from below the sea. At the Rincon field a well has been bored which is more than half a mile from the mainland. The discovery that holes already very deep could be drilled even deeper and actually deflected to reach new sections of oil pools has given Huntington Beach a new boom.

From an airplane you look down on "tank farms," where oil is stored; clusters of white metal tanks appear like giant frosted cakes; roofs of still larger reservoirs, built like ponds, are protected by lightning rods. These, the roaring refineries, the long pipe lines, trains of oil cars,

Photograph by Clifton Adams

SYMBOLS OF DESERT CONQUEST ARE SHOVEL AND IRRIGATION DITCH

Not the man with the hoe, but the man with the long-handled shovel, is characteristic of all irrigated regions in our arid West. From mountains come the waters; then infinite toil, knowledge, and Nature turn dry sands into fertile lands.

and tank steamers loading at the ports, are the outward and visible signs of this trade now operating under the Oil Code in an effort to avoid overproduction and to stabilize prices. All add their share of action and color to that ever-shifting, man-made kaleidoscope which is life to-day in this country where blossoming orchards end abruptly at the desert's edge.

Life here is never static; to-day's things are gone to-morrow. As I write, the *Times'* "wildcat whistle," long used to announce an extra issue, screeches again as the cornerstone of its third and latest home is laid—a home of copper, steel, and stone, rising now opposite its second home, built only a few years ago to replace one dynamited during labor troubles.

Faster ships in the harbor; bigger and faster planes to New York; longer water tunnels, and greater reservoirs. Ride through it, as I say, and southern California seems full-grown, mature; but fly over it, or look at Land Office records, and you see how much vacant land it still holds which can be reclaimed when the great power and waterworks are finished—if there be need for it.

How long the economic slump of the past few years may affect further migration to this section is problematic. Of the 784,541 visitors from outside States who came to southern California in 1933, a subnormal year, many thousands will remain or return to live, for that rule is as old as Bible history. But in the Middle West, from whence the tide of retired farmers used to flow, not so many can sell out nowadays with enough to live on.

Yet these west-bound human tides flow in cycles, and history proves how they persist. Look into the annals of migration since Abraham went "out west" from Babylonia; the drift of white races has been ever to the west. From Europe they came to our Atlantic coast. Our fathers saw them settle the Middle West, and our own generation has overrun the Pacific coast, which is the white man's last stand, for beyond the Pacific there is no space for him.

Look only at the map, at the magic growth of Los Angeles harbor, and you see why this is so, why Pacific trade routes are spreading, why our Navy is based here and frequents the Aleutian Islands, and what is meant by "the dawn of the Pacific Era."

COASTAL CITIES OF CHINA

By W. Robert Moore

Author of " 'Land of the Free' in Asia," "Cosmopolitan Shanghai," "The Glory That Was Imperial Peking," "Motor Trails in Japan," etc., in the National Geographic Magazine

AMERICA'S first foreign trade as a new-born Republic was with China. From Amoy, aboard British vessels, had come the tea which was dumped overboard at the famous Boston Tea Party. But within six months after England had accepted the independence of the Thirteen Colonies our own first merchant vessel, the newly christened *Empress of China,* was already on the high seas, bound for Canton—and tea.

One can picture the feverish activity of New York harbor during those early days of 1784 when the little 360-ton ship was reaching the final stages of her overhauling and was being loaded with 30 tons of ginseng (China's "dose of immortality"), 2,600 fur skins, 1,270 camlets, and small quantities of cotton, lead, and pepper.

Then came sailing day, Washington's Birthday. The departing *Empress of China* voiced a salute of 13 guns; the battery responded with 12.

In his pocket Captain Green carried a sea letter, penned by the young Congress and addressed to the "Most Serene, Most Puissant, High, Illustrious, Noble, Honorable, Wise and Prudent, Lords, Emperors, Kings, Republicks, Princes, Dukes, Earls, Barons, Lords, Burgomasters, Councillors, as also Judges, Officers, Justicians, and Regents of all good cities and places, whether ecclesiastical or secular, who shall see these patents or hear them read."

Thirteen months later, after four months at Whampoa, anchorage for Canton, the sturdy ship was back in New York, her holds filled with 403,000 pounds of tea, 962 pieces of chinaware, 490 pieces of silk, 42 nankeens, and 2,790 pounds of cassia.

THE BIRTH OF OUR MERCHANT MARINE

Her successful voyage signaled the expansion of our merchant marine. Tiny ships, manned by youthful American sailors, were soon prowling the Eastern seas, beating the monsoons up the China coast, and cluttering the Canton harbor. The China trade was on.

Homes in Salem and Boston, and, to a lesser degree, in New York and Philadelphia, became veritable museums of Chinese goods and curios. In 1790 the China trade represented approximately one seventh of our foreign imports. Within another fifty years our vessels were bringing home about 15,000,000 pounds of tea annually. This trade also gave birth to the swift clipper ships.

American enterprise, however, came to China much later than that of European nations; for, be it remembered, the disappointing New Continent's wildernesses, inhabited by savage redskins, appeared on the horizon when Old World adventurers sought China's riches by sailing westward.

But what of the China coast to-day, the lodestar which attracted those early explorers? To seek its answer I cruised the greater portion of the 2,000-mile arc of its indented coastline on local steamers that ply between the several ports.

Ocean liners from the chief world ports touch China at cosmopolitan Shanghai and British Hong Kong, 90-year-old products of occidental commerce with China. For sentiment's sake, however, let us take a four-hour steamer ride across to Macao (Macau) from Hong Kong and there begin our coastal visit. By so doing we shall catch the beginning of the thread in the network of sea trade and land grants that foreign nations have woven along the China coast.

A PATCH OF MEDIEVAL EUROPE IN CATHAY

Macao is a transplanted city, a bit of medieval Europe tucked in a Chinese setting. The pink, blue, and other pastel-colored buildings that line the water front and dot the hills up to the walls of historic Monte fortress, the weathered churches, and Government offices are Portuguese. True, the majority of shops are hung with chromatic signs bearing Chinese ideographs, for the city's population is 97 per cent Chinese, but the banner that floats over the tiny area of little more than 11 square miles is the red and green emblem of Portugal.*

Here it was that early in the 16th century Portuguese traders, extending the oriental sea route which Vasco da Gama had carved around Cape of Good Hope to India, first opened commercial relations with opulent

* See "Flags of the World," by Gilbert Grosvenor and William J. Showalter, in the National Geographic Magazine for September, 1934.

Photograph by Robert F. Fitch

LONG HAULS IN CHINA ARE MADE BY WATER

The Chinese have appreciated water transport for centuries, and although this method is slow a huge volume of cargo is handled in small boats of various types. These are usually poled or rowed except when a favoring wind or current gives the crew a rest.

Cathay. Here they founded the pioneer European settlement in the Far East and held the monopoly on Chinese trade until the 18th century.

In 1557 the Portuguese received conditional cession of this territory because of their assistance to the Chinese authorities in an attempt to subdue the pirates that infested the coast and the river approach to Canton. Pirates still lurk just around the island corners to plunder hapless vessels, and the Portuguese still control the rocky peninsula and two near-by islands, where they gained their first foothold.

EARLY SOLDIERS OF CHINA FORTUNE

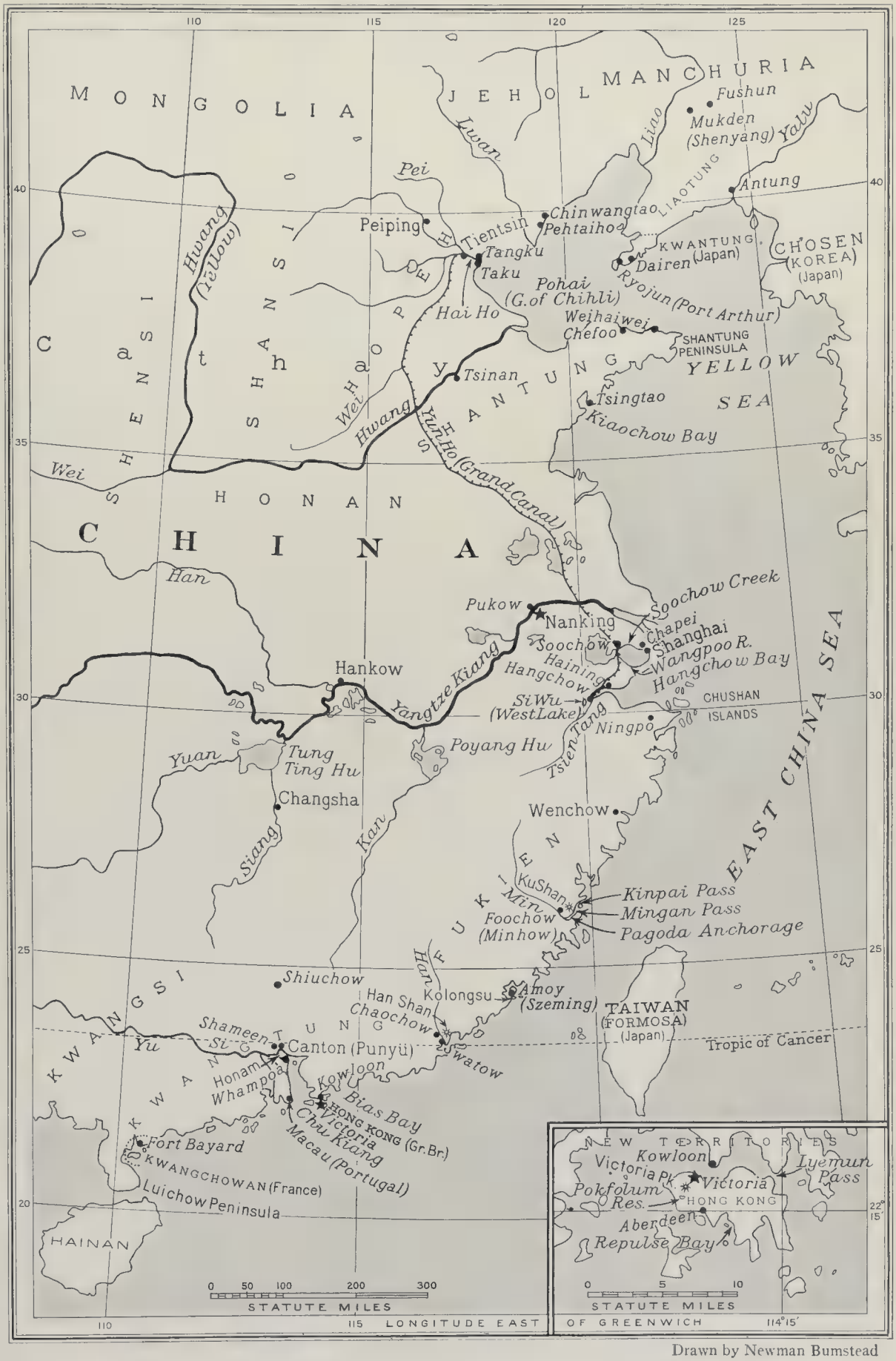
Here came the Dutch to be repelled by Portuguese battleships and the Monte guns; later, the long arm of the East India Company stretched across the sea to reach into Macao's rich trade pocket. To all early sea trade with Canton, Macao served as gateway. Even the *Empress of China* had to stop here to get the official Chinese permit before she could proceed to Whampoa Anchorage.

How truly the little possession served as the China outpost is revealed by reading the epitaphs carved on some of the tombstones in the little Protestant cemetery. Names of sailormen and merchants from Boston, Salem, and British ports appear frequently. Here, too, rest Robert Morrison, the noted British missionary; Edmund Roberts, special diplomatic agent of the U. S. A. to several Asiatic courts; Thomas Waldron, first consul of the United States for Hong Kong, and others who featured in the early intercourse with China.

Macao has lost much of its commercial luster since Hong Kong sapped its vitality; yet to-day its volume of commerce is greater than in early years, although insignificant in proportion to the total trade now carried on in this region. With recent harbor constructions at the cost of some $2,500,000 and a reclamation project of 130 acres, it again makes a bid for greater attention.

Fish, firecrackers, opium, and gambling are now Macao's chief stock in trade.* The important, colorful fishing industry employs some 2,000 junks and 50,000 men and women (see pages 623 and 625).

* See "Macao, 'Land of Sweet Sadness,'" by Edgar Allen Forbes, in the NATIONAL GEOGRAPHIC MAGAZINE for September, 1932.



Drawn by Newman Bumstead

FOR 2,000 MILES STRETCHES CHINA'S COAST, WITH BUSY CITIES AND PORTS

From historic Portuguese Macao to modern Japanese Dairen, the author sailed to record changes since the first American merchant ship left New York for the Orient.

As we leave for Canton we watch disappear behind us the blue-green hills, atop one of which is the Guia beacon that in 1864 flashed the first light to mariners in the China Sea.

To get to Canton it is usually easier to return to Hong Kong and then make the 100-mile journey by steamer or railway.

If recent years have brought little change to Macao, the same cannot be said of Canton. The ancient southern metropolis has been undergoing long-needed beauty treatments, and from it a new Canton is emerging. Little more than a decade ago Canton presented much the same appearance as when the clipper ships were lading their cargoes from its musty godowns. It was Chinese—deliberately, stubbornly Chinese (see illustration, page 622).

A NEW CANTON EMERGES

To-day old suspicions have been minimized. The Bund, formerly a muddy track lined with rat-trap buildings, is now a wide, well-paved thoroughfare fronted with modern eight- and nine-story hotels, department stores, commercial houses, and an up-to-date Customhouse. Narrow streets and alleys, accessible only to the traffic of wheelbarrows and sedan chairs, have given way to wide streets to such an extent that tour conductors find difficulty in playing up the "tortuous channels" of old Canton.

The visitor who a few years ago wrote that "you have to choose your place to knock the ashes off your cigar, or they will alight in a dish of soy or dried duck, on the one hand, or a pile of wonderfully wrought silk embroidery on the other," could now whisk through 60 miles of wide, paved streets in one of the thousand or more motorcars that honk their way through the city. Thousands of buildings were razed and much of the old wall demolished to provide for these modern arteries of bustling Canton. The great fire of 1927 also assisted in clearing ground for these sweeping changes.

"Everything new originates in Canton," say the Chinese. Politically, there is much truth to this statement. Here is where Sun Yat Sen found followers for his three principles of Kuomintang. By popular subscription, a modern monument and Memorial Auditorium, in which new political ideas are born and talked into vigorous activity, has been built as one of Canton's forms of recognition of the late leader.

Two new bridges are being constructed across the Chu Kiang (Pearl River), linking Canton city with Honam Island. I also found some of the old temples converted into schoolrooms and the Cantonese boys and girls enjoying tennis, handball, and basket ball on courts laid out in the ancient enclosures.

SNAKE MEAT—SERVED IN BROTH

All of the old, however, has not disappeared. In narrow lanes I found secluded restaurants selling snake meat, served in broth. Elsewhere men and boys worked elaborate embroidery patterns on silk in half-lighted rooms (see illustration, page 606). Near by a boy was weaving magic colors in shimmering silk on a crude loom, his dingy cubicle illuminated for night work by a single smoky oil flame.

In other alleys I watched laborers cut and polish jade rings and bracelets on primitive foot-treadle machines and marveled at the skill with which they shaped the resistive stone. Here is the center of the jade workmanship that has attained world-wide renown.

There also is ivory. "This piece took three months to carve," explained an ivory manufacturer, handing me one of those delicately wrought balls of ivory which had ten concentric lacelike balls, each moving freely within the next larger one.

"How do you do it?" I asked. He showed me another being carved. With no pattern and using only tiny, hand-made tools, a craftsman was drilling here, reaming there, and engraving the surfaces, as he cut the spherical piece of tusk into the several balls.

As when early shipments of porcelain and pottery were taken to Europe and America, there to acquire the name of "Chinaware," so potters still sit at their wheels and continue to keep their kilns fired, although not on the scale of former years. Canton exports about 40 per cent of the three million dollars' worth of pottery that annually goes into world markets from China.

THOUSANDS STILL LIVE ON BOATS

Another feature of Canton that has changed little through the years is the teeming boat life of the Pearl River and interlinking system of canals. Big boats, little boats, gay boats, and tawdry boats—Canton has them all. Here is a city in itself, with a population estimated between 100,000 and 200,000 people. Formerly

Photograph by W. Robert Moore

CROSS-STREETS IN HONG KONG HAVE THEIR UPS AND DOWNS

Because the main business thoroughfares usually run parallel around the steep hillsides, the intersecting streets are stair-stepped or are sloped so sharply that they are accessible only to foot and sedan-chair traffic. About 360,000 Chinese live and keep shop in the city, and an equal number reside in Kowloon, across the harbor, and on junks and sampans. The foreign residences are located on the higher levels and around the Peak, reached by cable tramway (see text, page 608).

Photograph by Robert F. Fitch

A LOAD OF PAPER SAILS OUT TO A WAITING STEAMER IN HONG KONG HARBOR

Most Chinese paper is made from rice straw or bamboo, which is steamed and decomposed with lime and then washed. The soupy pulp is sieved into thin layers; several of these are then superimposed on each other to be pressed and dried. Rice straw yields the common paper, while bamboo furnishes the better grades, used for printing and for window panes.

Photograph by W. Robert Moore

IN CANTON, EMBROIDERING IS A TASK FOR MEN AND BOYS

Working in dark, stuffy cubicles off narrow alleys for long hours every day, these humble laborers produce exquisite embroideries. Many of the so-called "Spanish shawls" are products of Canton's industrious needles.

there were many more, but a destructive storm a few years ago capsized and demolished many of the craft.*

Tiny sampans serve as "taxis" through this aquatic city. Housewives, cooking on small charcoal braziers on the stern decks of their floating homes, need only lean over the gunwales to do their daily shopping. Venders of vegetables, foodstuffs, cooking utensils, and other household necessities paddle alongside to supply every need.

On many of the boats I saw chickens and babies tied by leashes sufficiently long to give them the freedom of the deck, but preventing them from falling overboard (see page 638). Here and there a small flower box bravely flaunted its foliage and color.

Gaudy teahouses and funeral barges are also a part of this unusual panorama of boats. In fact, there are few phases of land life in Canton that do not have their duplicates afloat.

Photograph by C. W. Plass

"NEWSIES" DISPLAY, RATHER THAN SHOUT, THE DAILY HEADLINES OF HONG KONG'S FOUR ENGLISH NEWSPAPERS

Many of the lighters and trading junks still carry old swivel cannons on their decks or have painted circles to represent gun muzzles on dummy portholes as a protection against the river pirates. In midstream, however, lay several gunboats and destroyers, flying Chinese and foreign flags, which have a much more deterrent effect on piratical activities.

Consulates and other foreign interests are largely centered on Shameen, a 44-acre concession which was developed on a former sand bank a few years after Canton was formally opened by treaty, following the so-called Opium War of 1840-42. Previously, traders were limited to small "factories" on the Bund and did business with Canton through *hongs,* or special Chinese merchant groups.

Great Britain governs slightly more than two thirds of the small island and France the other portion.

Serving as clearing house for the wealthy provinces of Kwangtung and Kwangsi, Canton bustles with industry.

One third of its exports, principally raw and waste silk, is utilized by the United States.

* See "Life Afloat in China," by Robert F. Fitch, in the NATIONAL GEOGRAPHIC MAGAZINE for June, 1927.

During recent years rich Kwangtung Province has built several thousand miles of road connecting many of its interior cities; one is now being extended to Swatow, 220 miles distant as the crow flies. In other provinces as well, road construction holds high importance in the activities of the National Economic Council. In rural areas motorbusses have made issue with the centuries-old wheelbarrows and slow-moving canal boats.

Again, too, after a delay of 16 years, work is progressing rapidly toward the completion of the Canton-Hankow Railway. Begun by American engineers in 1903, it later suffered from international and local setbacks and, since 1917, has remained with a gap of some 280 miles between Shiuchow and Changsha (see map, page 603).

With capital recently released from the British Boxer Indemnity Fund, it is hoped that within two years the task will be pushed to a successful completion, thus supplying the final link to the world's longest ribbon of steel—9,000 miles. Hong Kong or Canton to Berlin and Paris via Siberia in 16 days is in pleasant prospect!

To-day you can step aboard a modern airliner at Canton and in two days glide down to the airport at Peiping, or you can speedily reach Shanghai by flying boat, winging on regular schedule, for modern China has taken to the air.

The wealth that pours through the Canton gateway is also the lifeblood of Hong Kong trade, because the greater portion of all Canton's exports and imports is transshipped in its majestic mountain-girt harbor.

THE MIRACLE OF HONG KONG

Hong Kong, like Singapore, is a tribute to British commercial enterprise in the Far East. Ships of the Seven Seas enliven the harbor and bring business to the vigorous city that now rises on the once barren islands where dwelt a few fishermen, stonecutters, and bands of pirates (page 606).

"It is a delusion to hope that Hong Kong can ever become a commercial emporium like Singapore," wrote the despondent colonial treasurer in 1844.

But, instead of delusion, the miracle has been achieved! Large business and Government buildings along the water front, palatial houses clinging boldly to the precipitous hillsides, schools, universities, shipbuilding docks, cement factories, and sugar refineries; a strategic commercial and naval base—this is Hong Kong.

Several times tonnage figures have placed it among the world's principal seaports. At present, approximately 50,000 vessels, carrying in their holds more than 40,000,000 tons of cargo for foreign trade, cut furrows in and out of the harbor annually. And British colonials find romance, not dull figures, in these shipping statistics, because, except for a few articles of local consumption, Hong Kong is a free port. Consequently, its very existence depends upon its service as distributing center for all South China.

To be geographically accurate, one should call the city Victoria, but, save for official documents, the port has taken the name of the island colony, derived from the Chinese Heung Kong (Fragrant Streams, or Good Harbor).

To the mountainous Hong Kong colony, Kowloon, on the mainland opposite, was added, later to be extended again by the inclusion of the specially leased New Territories (see illustration, page 620). In all, this oasis of British-controlled activity now embraces 391 square miles.

After you have explored Hong Kong's Chinatown, splashed with its colorful hieroglyphics, the stair-stepped streets (see page 605), markets, and curio shops, take a ride up the cable tramway to the Peak; or, if you desire, you can make the steep ascent in a bobbing sedan chair, carried on the shoulders of perspiring coolies. Here, high above the noise of commerce, you are among the palaces of the wealthy.

At your feet the teeming city spreads like a mighty sweeping sickle along the harbor. Lying along the Praya, tied to midharbor buoys, and churning up slender white wakes in the jade-tinted waters, are the argosies of half the world. A mile beyond, sprawling white on the red earth, is Kowloon, with its hotels, warehouses, and jutting piers.

A plume of white steam rises above a liner's funnel—another ship is off for San Francisco, London, or Marseille. Tiny junks lift their matting sails; back and forth between Victoria and Kowloon ply double-nosed ferries, carrying 35,000 commuters daily.

Come up again at night, when the city lights have sprung to life and naval greyhounds are conversing in flash-beam semaphore; you will see a magic land. Day or night, it is an unforgettable panorama.

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Finlay Photograph by W. Robert Moore

PEIPING'S LOFTY "WHITE DAGOBA" HAD TIBETAN INSPIRATION

It was built in 1652 as a compliment to the Dalai Lama, of Tibet, on his visit to the Chinese capital. The structure base, body, spire, lofty ornament, and gilded ball represent the five elements—earth, water, fire, air, and ethereal space. Elaborate memorial archways, with heavy posts and sloping supports, frame the approach to this landmark, which rises beside the city's three lakes.

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THE COMEDIAN OF A THEATRICAL TROUPE

Like the clowns of an American circus, this youthful performer, who strikes a pose with his tongue in the corner of his mouth, wears a distinctive facial make-up.

Finlay Photographs by W. Robert Moore

THE VANISHING MILLINERY OF THE MANCHUS

Although China became a republic in 1912, the Manchus were allowed to live in the palaces at Peking until 1924. Since then, their costumes have not been seen on the streets.

© National Geographic Society

BY THEIR HATS YOU ONCE KNEW OFFICIALDOM

Among the Chinese the mandarin hat, with its bushy plume and grade-distinguishing button, has gone out of date, but in Mongolia it is still worn by princes and men of high rank. This young man is a relative of one of the princes of eastern Mongolia.

Finlay Photographs by W. Robert Moore and Owen Lattimore

PERMANENT WAVES AND LONG BOBS IN MODERN CHINA

This lady, of royal Manchu blood, is the wife of a Mongol prince of eastern Mongolia, but she and her husband live most of the year in Peiping. Her pet is a Japanese spaniel. In high-collared, close-fitting gowns the modern woman of China has found a distinctive style.

A WEDDING PARTY PARADES THROUGH THE CITY'S STREETS

The small procession passes under an ornamental archway, the bride riding in a palanquin, or enclosed litter, borne on men's shoulders. Hardly a day goes by in Peiping without one or more colorful processions. Sometimes it is a wedding, sometimes a funeral.

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Finlay Photographs by W. Robert Moore

"MOON RABBITS" OF A HARVEST FESTIVAL

The Harvest Moon Festival, coinciding with the autumn equinox, is one of the important old Chinese celebrations. As in other lands, the Chinese picture a rabbit in the moon; so gaily painted figures, such as these, are given as presents to the children.

THE CHIEN MEN IS PEIPING'S PENNSYLVANIA AVENUE

It is in direct line with the Imperial Forbidden City and was used by the emperors when they visited the Temple of Heaven to perform religious rites. The street gets its name from the central gateway on the south side of the Walled City, the guard tower of which rises in the background.

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Finlay Photographs by W. Robert Moore

MANCHU PRIESTS AWAIT THE ARRIVAL OF A ROYAL FUNERAL CORTEGE

After the Manchus were driven from the Dragon Throne, royal funerals lost much of their pomp. In 1932, however, when Manchuria was slipping from their grasp, the Chinese officials permitted the funeral of a lady of the late Emperor Tung Chih's court with full ancient ceremonies.

© National Geographic Society

PART OF "A WOMAN'S $50,000,000 WHIM"

With money intended for building warships, the Empress Dowager, Tzu Hsi, built a Summer Palace, with beautiful pleasure pavilions, chromatic religious domes, and a mile-long corridor, of which this forms a portion. China's defense was thereby weakened in her war with Japan in 1894.

Finlay Photographs by W. Robert Moore

GATE GODS ARE CHINESE INSURANCE POLICIES

Each New Year of the old Chinese calendar, which comes late in January or early February, many people paste these ferocious-looking images on their gates to ward off evil spirits. Officially, the Western calendar is now in use and an attempt is being made to abolish the lunar year

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"SWEETS! COME BUY MY SWEETS!"

The Chinese street venders seldom lack customers for their sweetmeats, fruits, rice, and soups. This itinerant merchant, in the Moslem section of Peiping, carries a supply of water chestnuts, candied crab apples, plums,

Finlay Photographs by W. Robert Moore

ON SOCIAL OCCASIONS EVEN THE HORSES WEAR HATS

Neither the tasseled headgear nor the red nets are to keep the flies from annoying the animals, for the photograph was made in midwinter. It was for a wedding that the horses were thus adorned and the carriage was decorated with red-and-gold embroideries and tinseled trimmings.

© National Geographic Society Finlay Photograph by W. Robert Moore

FALSE WHISKERS AND RESPLENDENT ROBES EMBELLISH CHINESE DRAMA

The two youthful actors wear conventionalized versions of ancient court dress. Dramas of history and myths predominate on the Chinese stage. Men act in both masculine and feminine roles, but recently a few women have appeared in some of the plays.

On several occasions Hong Kong has been visited by the typhoons that brew their viciousness in the China Sea. These storms, in which the wind blows as much as 120 or 125 miles an hour, have ripped through the harbor, causing great havoc ashore and among the ships. Sets of signals, however, are arranged to give sufficient warning, so that the launches, junks, and sampans can find refuge in the three typhoon shelters and larger ships can get to safe anchorages in protected bays.

Baggage comes aboard, winches are rattling, and hundreds of Chinese are shouting and strewing bundles and babies over the steerage deck—it is sailing time for the local steamer, bound for Swatow and other ports to the north.

We could have taken another steamer to Kwangchowan, on the southern bend of the coast, near where the Luichow Peninsula thrusts out toward the island of Hainan, but the visit would be of even less interest than has been the occupation of the French since they obtained a 99-year lease there at the close of the last century.

A RENDEZVOUS FOR PIRATES

Northeast from the narrow Lyemun Pass through which we sail is notorious Bias Bay. Ever since early days this district has had unsavory reputation as the headquarters of pirate gangs who infest the coast. Outwardly the settlement of 10,000 people of Bias Bay is agriculturist, but the activity is less serious as farming than as camouflage.

During the old sailing days these freebooters usually intercepted passing vessels by stretching a cable between two junks; then, as soon as the rope was caught by the victim's bows, the junks would be pulled alongside, so that the boarding of the vessel was an easy matter.

With the coming of steam-propelled ships, their technique changed to boarding the steamers as passengers and at the opportune moment taking possession, then forcing its officers to sail the ship into Bias Bay for looting.

When riding a coastal steamer to-day, you are comparatively safe from becoming the victim of these piratical attacks; but you do experience the feeling, strongly suggestive, of traveling in a floating patrol wagon, for the first-class accommodations and the bridge are protected by heavy iron grilles.

Many thrilling tales are told of these menaces to coastal shipping, some of which contain accounts of unusual bravery against heavy odds. Officers have accounted well for themselves in cracking pirates' heads with deep-sea leads and other weapons, and British judges have brought some of the cutthroat leaders to unpleasant "necktie" parties.

In these South China waters, too, are other pirate groups, some led by women, who specialize on fishing fleets and lighterage junks. Acting under the guise of "protection," they reap heavy tolls from the owners of these craft.

Ours, however, was an overnight voyage, with nothing more exciting than a near collision with a small fishing boat as we were drawing into harbor.

CITY OF LINEN, LACES, AND COOLIES

Spreading fanwise on the silt land built by the Han Kiang, Swatow has little to recommend itself from a visitor's viewpoint.

Its main importance lies in its service as shipping point for produce coming from Chaochow and other Chinese towns along the lower portion of the Han.

Its chief exports are linen embroidery and laces—and Chinese coolies. Fifty years ago the latter were in such demand that many traders began the lucrative business of kidnapping the natives and taking them to distant lands, where they were sold into what amounted to slavery conditions. With the hatred that these acts soon engendered, foreigners were barred from Swatow for several years.

Now thousands of Chinese leave Swatow in legitimate emigration (see text, page 619).

A woman sitting beside the doorway of her home, working deftly with needle on a piece of fine linen or grass cloth, is Swatow's chief symbol of industry. Walk through the side streets or visit the surrounding villages and you will find hundreds of women and girls thus employed.

The delicately embroidered linen, laces, and drawn work which they produce, usually under foreign direction, are exported almost entirely to American markets.

Down in the narrow byways, rotund, mustachioed Kut Hing and a number of his confreres also showed me countless pieces of foreign- and oriental-designed pewterware, incised with squirming dragons and glaring lions of Chinese mythology.

Photograph by Maynard Owen Williams

BASKET COALING OF SHIPS STILL PREVAILS IN DAIREN

Although modern machinery is now used extensively in handling coal and other products in Manchuria, the cheapness of coolie labor permits many tasks to be done more economically by hand. The famous Fushun open coal field, east of Mukden, is one of the richest mines in the world; its output has reached 7,000,000 tons in a single year (see text, page 642).

"Chaochow is plenty fine. You go?" inquired my Chinese cicerone after we had exhausted Swatow's places of interest.

I went, but in company with a member of the American consulate staff, who knew the ancient city and the interesting pottery-making village not far distant.

The 27-mile train journey through rice lands, cane fields, and orange gardens is in itself well worth the time spent; but to wander through Chaochow is to venture into medieval China. Here are no tall buildings, only the squat two- and three-story gray tile-roofed houses and shops, separated by narrow stone-flagged streets. Reducing these thoroughfares almost to a slender footpath are vegetable stalls, paper lantern shops, and the portable food kitchens of itinerant venders.

In the vicinity of the 11-centuries-old bridge, consisting of two stone sections and a middle pontoon of boats, are gathered hundreds of river boats, taking on and discharging the cargo that moves up and down the broad Han Kiang. Propped in twisted array above the abutments of the old bridge are other cubiclelike shops, catering largely to the river traffic.

RIDING THE "BAMBOO SPECIAL"

"Have you ridden on our other railway?" inquired the American consul, with a twinkle in his eye, when I had returned to Swatow.

It was the "Bamboo Special," with "exclusive passenger service." This unique line runs 10 or 15 miles in the country. The "coaches" resemble crude rolling beach chairs, built of bamboo and devoid of springs, which are pushed over a narrow,

unballasted track. Coolies furnish the motive power; and when two cars meet, one is derailed to allow the other to pass. Uncomfortable, yet it is well patronized.

AMOY, FAMED FOR TEA

Amoy, of tea fame, is the next port on our northern journey. Once considered one of the dirtiest and most backward cities of all China, it has been undergoing complete transformation during the last few years. Wide streets are being cut through the old ramshackle settlements; men and women are breaking rocks for the new roads and an extensive Bund, and are literally carving away some of the rock hills to make room for new developments; a park, the finest in all South China, has been recently built and excellently landscaped.

One Chinese merchant showed great pride in new rolling steel doors that he had imported at the expense of some $4,000; but the back walls of his shop could be crushed with a few blows of an ax!

Yes, Amoy's leaders even have visions of making the island city a second Hong Kong. "We have the best harbor along the coast and great undeveloped mineral wealth within easy access in the interior," they argue.

Where, you may ask, are they getting the money for all these improvements, since Amoy long ago lost her rich Taiwan (Formosa) sea trade? Much of it is coming from the returning people, who have made tidy fortunes in the Philippines, Malaya, and Netherland India.

It is significant to China's prosperity that about $200,000,000 or more is annually remitted to the homeland from Chinese living in other countries.

Across from Amoy is the island of Kolongsu, where are located the foreign concessions. Hundreds of gaily painted sampans afford transportation across the harbor and to the ships that anchor in midstream (see illustration, page 621).

"Peculiar people, these Amoyistas," chattered a foreign flour salesman, as we weighed anchor for Foochow. "Here they are building a new port, new streets, and new movie houses; yet I've been trying all day to convince the bakers here that the present brand of flour will make exactly as good bread as our old kind. In fact, it is the same, for both come from the same chute at the mill. They even baked some of both kinds and still aren't convinced!"

The old Chinese conservatism lingers in many forms and is difficult to overcome.

Steaming northward, our ship wallowed through heavy monsoon-tossed seas and under leaden storm-filled skies, each hour falling further behind schedule. Nearing the mouth of the Min Kiang, however, the boat steadied and the sun struggled bravely to dissipate the heavy clouds that hung on the mountain tops.

THE RHINELAND OF CHINA

The river approach to Foochow through the narrow Kinpai Pass and the even narrower Mingan Pass presents a striking panorama of scenic beauty. The river flows between bold rock walls backed by rugged heights. In fact, the whole 300-mile portion of the Min, navigable to shallow-draft vessels, possesses unusual charm and has been compared to the Rhine.

We passed a fleet of Foochow fishing junks, their brown sails bellying in the breeze as they steered out to their fishing grounds.

A short time later the steamer dropped anchor at Pagoda Anchorage, 10 miles below Foochow.

Foochow leaped into prominence in the fifties, sixties, and seventies as a source of bohea tea, grown in the northern part of Fukien Province. Here, at Pagoda Anchorage, the British and American clippers took on their cargoes and raced away to different parts of the world.

THE TEA RACE OF CLIPPER SHIPS

In 1866 there was a race from Pagoda Anchorage to London among the British clippers which is probably without parallel in the annals of sailing, not even excepting the thrilling races of the Australian grain ships. Five ships, laden with the first of the season's teas, left within three days of each other. With all sails set, they sped homeward, each striving for the lead.

Ninety days out of Foochow, two of them raced up the Channel side by side. The *Ariel* crossed the finish line eight minutes in the lead, but to the *Taeping* fell the honor of victory, because she had started from Foochow 20 minutes after the *Ariel*—a difference of 12 minutes on a 16,000-mile race! All the others arrived within two days.

To-day Pagoda Anchorage preserves the memory of those exciting clipper days by keeping whitewashed the stones around the harbor where the ships tied up.

Tea grown in Assam, Ceylon, and elsewhere has caused a serious decline in the Foochow trade. Merchants here now are turning their attention more to green teas,

Photograph by W. Robert Moore

THE GARDENS OF NEW TERRITORIES PROVIDE VEGETABLES FOR HONG KONG AND KOWLOON TABLES

Hong Kong, on the sharp hills in the background, looks across its busy harbor to the fertile fields of New Territories, which, with Kowloon, has been leased from China

Photograph by W. Robert Moore

FERRIES ARE ALMOST TOO INSISTENTLY "AT YOUR SERVICE" IN AMOY

Dozens of these sampan operators are usually shouting for the job of transporting passengers across the harbor between the native town and the foreign settlement, on the island of Kolongsu, a portion of which is shown here. The domed building on the hill at the left is a Japanese school. Above the two sloping masts, right center, appears the white façade of the American consulate, in Georgia colonial style (see text, page 619).

Photograph by W. Robert Moore

A MODERN SKYLINE RISES ABOVE A CLUSTER OF AGE-OLD CRAFT ON PEARL RIVER

Until a few years ago Canton was a maze of two- and three-story buildings, with narrow streets and tortuous alleys. To-day many wide motor roads have been cut

Photograph by W. Robert Moore

SNATCHING REST AT THE FEET OF A TEMPLE GUARDIAN

The shady niche that houses this ferocious figure at the entrance of the Temple of Five Hundred Genii, Canton, and the pedestal on which he stands provide quiet places for reading or sleeping. Gilded figures of the genii stand in rows in other rooms.

Photograph by C. W. Plass

A MACAO FISHMONGER DISPLAYS HIS WARES IN THE OPEN

The dried fish, which the dealer has strung up around the entrance of his open-front shop, are used by the Chinese as one of the ingredients in flavoring their bowls of rice. Fresh fish are often kept swimming in tubs of water until the purchaser makes his selection.

so popular with the Chinese, rather than the black teas for export trade.

Through attempts on the part of the Min Kiang Conservancy Bureau by dredging and building scouring dikes, it is hoped that all the sea trade can be brought to anchor at the Customs Bund in Foochow instead of at Pagoda Anchorage. Much of the traffic on the curve of the river between the two portions of the city is that of log rafts and gaudily painted Ningpo junks. Hundreds of these sturdy, high-pooped old junks carry to Shanghai and North China ports for building purposes the poles and timbers that are sent downstream from the upper reaches of the Min (see page 627).

We went among these brilliantly decorated junks and talked with the weathered old Ningpo sailors who manned them.

"We sometimes come down from Shanghai to Foochow in five or six days," explained a captain, as he stood supervising the overhauling of the sail rigging that was being wrapped around a large hand-operated capstan. "Going back loaded this way," indicating the filled holds and heavy piles of poles lashed on the outside of the gunwales, "we get there in five or six weeks, maybe."

Thousands of houseboats and other small river craft are also gathered near the midstream islands and along the banks on either side of the old stone bridge, the "Bridge of 10,000 Ages," that joins the ancient walled city with its newer suburb (p. 636).

LACQUER WARE A FAMILY INDUSTRY

The lacquer ware of Foochow has long held a high position for its excellence and rich colors. In some of the little home factories the managers boasted that their families had carried on the manufacture of special lacquers for many generations. One shop proudly displayed the certificate of first prize that was awarded for a display of lacquer at the St. Louis Exposition.

Near Foochow, secluded high in the mountains, are several Buddhist monasteries. One day we climbed to Ku Shan, far above the watery plain and the meandering Min, to visit the famous old monastic buildings, lineal descendants of the group that was first built there eleven and a half centuries ago.

Here, amid whispering pines, in these ancient temples and monastic quarters, priests clad in blue-gray robes have found retreat from the world, like the monks of Montserrat and Mount Athos, and twice daily repeat their litanies before the enshrined Buddhist deities.

HARVEST PILED ON TEMPLE ALTARS

It was harvest season; in some of the temples the winter supply of yams was piled high around the base of some of the altars. People from the plains, on pilgrimage, were also bringing baskets of rice to present to the monks.

Of more interest, however, than the fine old specimens of Chinese religious architecture or the pool of sacred golden carp was the magnificent view of the tumbled mountain landscape and the rich patchwork farms on the valley floor.

Through the thin veil of haze, Foochow and its boat life stood out distinctly; far down on another bend of the river I could see Pagoda Anchorage, with several tiny dots that were ships. Yet the rush of daily life seemed remote indeed. On the morrow I was to be on one of those steamers that would carry me on another stage of my coastal pilgrimage.

Once out to sea, storm clouds again closed around us.

"These seas aren't bad yet," encouraged the captain, as the little steamer rose and reeled over on the whitecaps and into the trough of the waves. "You should see them during some of the typhoons we have run into. Why, one time right along here we got into one blow when, with anchors dragging and the engines on full speed ahead, we were actually going backward two or three knots!"

Threading the Chushan Islands and the dangerous rocks of Hangchow Bay, many of which could tell tales of disastrous shipwrecks, we came to the mouth of the mighty Yangtze Kiang, gateway to Shanghai and the wealthy interior.

Like Hong Kong, distributing center of the south, Shanghai had to rise as the clearing house for the vast valley region where dwells one eighth of the human race. It would have been as easy to have no New York, no San Francisco, no Istanbul as to have had no Shanghai. Trade demanded it.

Here have been raised some of the tallest skyscrapers outside the American Continent; here is an unbelievable, strange mingling of East and West, sprung up mushroomlike to meet the needs of commerce.

Radiating from this mighty city are active airlines, touching Canton, Peiping, Hangkow, and interior towns. Railways and roads are likewise probing the hinterland.

Photograph by W. Robert Moore

AN ORIENTAL SUNRISE PAINTS THE DRAPERY OF DRYING NETS

Hundreds of fishing boats lie anchored in the quiet waters of Macao's outer harbor. In centuries past this was journey's end for the caravels of Europe, which made their long voyages for cargoes of silk and tea. The flag of Portugal still flies over the China Sea port, but much world trade has shifted to Hong Kong, so that fishing is now one of Macao's chief industries (see text, page 601).

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THE THROBBING LIFE OF CHINA'S CITIES SPILLS OUT UPON ITS WATERWAYS

Busy Soochow Creek teems with houseboats and launches, freight barges and vegetable craft. This waterway, a Broadway of Shanghai, is linked with the historic Grand Canal and flows into the Whangpoo River. The left of Garden Bridge, on the

© Paul De Gaston

THE HIGH-POOPED NINGPO BOATS SEEM LIKE WATER-BORNE SKYSCRAPERS

Ponderous seagoing junks, bearing building timbers and poles from Foochow, drop anchors in the muddy Whangpoo. With their holds filled and the piles of poles lashed at the gunwales, these ships had fair sailing weather and made the 600-mile journey northward to Shanghai in five or six weeks.

© Paul De Gaston

A GOOD YARN WHILE THE CHOPSTICKS FLY

Perhaps the photographer is regaling them, while they eat their noodles and rice, with a description of the strange concoctions which pass for oriental food in American "Chinese restaurants."

© Paul De Gaston

"NOW UNDER AND THE CAT'S CRADLE IS FINISHED!"

By rare good fortune these girls in Shanghai were so absorbed in playing with a piece of cloth that they did not notice the stalking photographer. As soon as the shutter clicked, however, they scampered away.

© Paul De Gaston

BACKDOOR SHOPPING IN THE CANAL STREETS OF HANGCHOW

The market man, also the candy man, the hardware salesman with cooking pots, and the jeweler with "costume" trinkets, all ply the busy waterways of Chinese cities with their stocks. Beyond the peddler's craft are several rafts of bamboo poles. Hangchow, with its beautiful lakes and many canals, reminded Marco Polo of his beloved Venice (see text, page 641).

© Paul De Gaston

BY "YULOWING" HIS BOAT THE CHINESE NEVER GETS HIS OAR TANGLED IN TRAFFIC

He pushes and pulls the long, pivoted handle, and the blade moves back and forth in the water directly astern, after the manner of a fish's tail. The boat can thus be

© Paul De Gaston

LUCKY RIVER "TAXIS," TO FIND PARKING SPACES ON THE SHANGHAI WATER FRONT!

These oddly shaped sampans ferry passengers across the Whangpoo and out to steamers anchored in midstream. Many launches operate, but the needs of the 3,000,000 residents of greater Shanghai and of many transients still enable hundreds of sampan "drivers" to gain a livelihood. The matting roofs shield passengers from rain or sun.

© Paul De Gaston

HOMEWARD A HANGCHOW FARMER POLES HIS AQUATIC WAY

He is bringing a load of fertilizer down a creek to his fields. Because of the hungry mouths of the country's millions of people, no plot of good earth can long remain fallow. By spreading the land with silt from river and canal beds and by careful fertilization, Chinese peasants have maintained the richness of their farms for 40 centuries.

AND THAT'S WHY COOLIES WERE BORN

Straining at the towlines, they symbolize China's cheap manpower for freight and passenger hauls.

Photographs by Paul De Gaston

A WHEELBARROW COOLIE CLEAVES A WIDE PATH IN SHANGHAI

Bells are often strung in the wheels, adding their tinkle to the creaking of ungreased axles.

© Paul De Gaston

ANCIENT STONE BRIDGES ARCH THE STREET CANALS OF VENICELIKE SOOCHOW

Gracefully designed to allow the passage of boats and often provided with carved balustrades, these curved spans are found throughout China. Some of the arches are so high and steep that the pathways over them have to be stair-stepped.

© Paul De Gaston

BENEATH SOOCHOW'S BRIDGES GLIDES A STRANGE "FLOATING POPULATION"

Thousands of Chinese find no room on their country's overcrowded soil; so in ramshackle boats they grow up, marry, rear families, and die without knowing any other home. At the stern of a typical houseboat the mother takes her turn at the oar. On the roof of the craft is a fish net, and the poles beyond flaunt the family wash.

Photograph by W. Robert Moore

ONE CAN ALMOST WALK ACROSS THE MIN RIVER AT FOOCHOW DRY-SHOD, ON RAFTS

Quantities of logs are cut from the forested hills of Fukien Province, and are then floated downstream to this port, whence they are shipped by sailing junks to Shanghai and other cities. Less than a century ago Foochow was one of the busiest centers on the China coast, because of its enormous tea trade. Clipper ships then raced away with as much as sixty-five million pounds of tea in a single year; now the export has dwindled to as little as two million pounds in

© Paul De Gaston

EVEN THE HARVEST COMES HOME BY WATER

These farmers, passing through a small village near Shanghai, bring sheaves of rice from outlying fields to their threshing floor. After the grain is removed, the straw will probably be used for fuel or mats, or will be sold for packing purposes. Steps lead down the embankment from all of the homes, for the stream serves as laundry and source of water supply as well as highway.

© Paul De Gaston

THE NARROW DECK SPACE IS THEIR ONLY PLAYGROUND

These youngsters were born aboard the little boat, and they probably will spend their entire lives afloat, as have their ancestors, seldom setting foot on shore. Buoys are often tied to babies, so that no harm will come to them should they accidentally fall overboard.

© Paul De Gaston

A BOATLOAD OF RICE MIDWAY BETWEEN FIELD AND CHOPSTICKS

Freshly threshed cereal is being transported to Soochow, where it will be husked and polished for family consumption. Despite the enormous amount of the grain grown in the country, China does not produce enough for her own needs. In North China wheat, millet, and other grains, not rice, form the main diet.

© Paul De Gaston

FRAGRANT INCENSE ASCENDS TO THE GODS

So many joss sticks are burned daily in this bronze urn in a Shanghai temple that the ashes keep the metal constantly warm. Sometimes it is too hot to touch. After the woman has lighted all of the sticks she holds, she will kneel on the pad and make a few bows while muttering a petition. Shopkeepers do a thriving business selling incense just outside the temple doorway.

The story of transportation, however, is yet near its beginning; the leaders of China are now planning with their ears attuned to the hum of motors. Within the last few months the Chinese banks have organized a Chinese Development Finance Corporation to aid in this ambitious construction program, a forward stride which but a short time ago would have been considered too visionary to contemplate.

Shanghai's contrasts are everywhere vivid. Its night clubs, taxi dance halls, and centers of sport and recreation, where its many peoples spend gay hours to forget shipping statistics, bills of exchange, and business worries, make Hong Kong appear almost Sabbathlike in comparison.

But pulsing Shanghai is a story in itself.*

To-day, in Chapei, north of the thriving International Settlement, are the blackened, seared wounds caused by bombardment and fire. Soon those, too, will be healed by new shops, new business houses, and finer, more modern homes. Nothing in Shanghai remains static long.

THE CITY MARCO POLO ADMIRED

Before leaving the Shanghai region one should motor or go by train to Hangchow, 110 miles southwest of the commercial capital (see pages 629, 632). It was Kinsai, "The City of Heaven," which Marco Polo declared to be the noblest city of the world.†

Long before Marco lived there as high officer of the Mongol conquerors, Hangchow had twice risen to magnificence—first under the Wu-Yueh kings, and again under the Southern Sung Dynasty.

If the accounts of the Venetian and others are to be relied upon, Hangchow was the luxury-loving Rome of China, for its many bridges, baths, and magnificent palaces that encircled famous West Lake caused extensive comment.

Many of the historic monasteries still exist. West Lake is, as always, the center of scenic beauty, although now only about half the size it was in Marco Polo's day.

Appropriately, the city is noted for its silk and for its lovely fans.

Ningpo, a few miles east of Hangchow, was once looked upon as an important trading center by foreigners, but Shanghai has not only sapped its trade, but many of its most progressive peoples. Ningpo sailors, however, are recognized as hardy seamen, and their huge junks can be seen everywhere along the coast (see text, page 624, and illustration, page 627). Ningpo, too, was the home of Chiang Kai Shek, former President of the National Government.

TSINGTAO WAS BUILT BY GERMANS

Returning to Shanghai, I shipped for Tsingtao and the other ports of North China. Steaming into Kiaochow Bay, at the southern base of the Shantung Peninsula, one sees the red-roofed homes of Tsingtao come into view. The aspect is that of a foreign town, as indeed it is. In years prior to its occupation by the Germans in 1897, as a military and naval base, Tsingtao was little more than a fishing village. The Germans built wide streets, modern homes, a large pier and other harbor improvements, and heavy fortifications.

During their occupation, which lasted until 1914, they built the railway to Tsinan to connect with the Shanghai-Pukow-Tientsin line and to open up the rich Shantung Province. Roads, too, were thrust inland. Much of the development of the region, however, came during the eight-year period of occupation by the Japanese.

When the wind is blowing, Tsingtao advertises strongly one of its chief exports, coal. The gusts of wind are filled with the fine dust that is swept off the cars and off mammoth piles of coal that lie along the dock where blackened coolies load it basketful by basketful into the vast maws of the waiting steamers. From Tsingtao, too, are shipped more peanuts than from any other port in the world.

Here is the Atlantic City of North China for residents of Shanghai, Tientsin, and other ports; during the summer months many foreign families seek surcease on its friendly beaches from the stifling summer heat. With the United States Submarine Flotilla anchored in these waters during the hot weather, the resorting season is usually a gay social one.

We sailed next for Chefoo, on the northern coast of the Shantung promontory, omitting Weihaiwei, the harbor which served Great Britain as a naval sanitarium and fleet base for 32 years, prior to its rendition to China in 1930.

Chefoo is one of the chief commercial cities of Shantung, and it has become

* See "Cosmopolitan Shanghai, Key Seaport of China," by W. Robert Moore, in the NATIONAL GEOGRAPHIC MAGAZINE for September, 1932.

† See "The World's Greatest Overland Explorer," by J. R. Hildebrand, in the NATIONAL GEOGRAPHIC MAGAZINE for November, 1928.

widely familiar because it is the summer headquarters of the United States Asiatic fleet. Within its mountain-girt harbor and behind its breakwaters 20 to 30 of Uncle Sam's greyhounds are usually anchored from May to September.

THE AUTHOR "JOINS THE NAVY"

In Chefoo I joined the Navy! I had spent much time in photographing the fishing boats along the water front and in getting views of the harbor from a distant hilltop, so that when I returned the tender had already left for the ship which was to sail in a few minutes. A Chinese offered to row me out in a sampan, and we arrived just as the anchors were being pulled up. Another sampan was at the gangway, so I had to cross it to get to the steamer.

Laying down the sum upon which we had agreed, I started to step across into the other boat. At the same moment the sampan coolie decided that I should pay even more dearly for my ride and began pulling his boat away, with the inevitable result that I, my cameras, and the color plates I had exposed received a ducking.

As we steamed through the Gulf of Pohai (Chihli) toward Tientsin, I strewed the upper deck with drying camera parts and soggy clothes.

Swinging into the Hai, river approach to the commercial capital of North China, we passed the demolished Taku forts, grim reminders of four attacks by foreign forces. A short distance farther on, we came to dock at Tangku. Because of the deposits of silt, many of the steamers discharge their cargo here, to be lightered or sent by rail to Tientsin. Ships of more than 14-feet draft have always had to drop anchor in the gulf, about eight miles off Taku.

Along the river and at Tientsin are many salt works, cotton mills, and flour mills. Flour milling is the chief industry, because of the vast wheat lands that lie inland beyond Tientsin. The 12 large American flour mills and the six cotton centers, operating nearly 222,000 spindles, provide employment for many people of the locality. Because of its proximity to the extensive grazing districts of North China, Tientsin is also the chief wool-exporting center.

To-day the city gathers trade from the caravan routes, canals, and railways that thrust their slender fingers into all parts of the Hopeh district and out into Shantung, Honan, Shansi, Shensi, Kansu, and Mongolia. The present loss of Manchuria, however, has temporarily slowed the port's commercial stride.

There are few attractions of Chinese architecture in Tientsin, such as Peiping possesses. Instead, the city is conspicuous for its fine banks and administration buildings. The British, French, Japanese, and Italian Concessions, which bracket a portion of the winding river to the south of the native quarter, impart to the place a strong Western flavor.

One site, however, the Sea View Buddhist Temple, is of historic interest. Here Lord Elgin signed the Treaty of Tientsin in 1858, which eventually opened this and several other ports to foreign trade.

A BELL OF MANY FUNCTIONS

In this reconstructed temple is a bronze bell, presented by Krupp, of Essen, to Governor Li Hung Chang as a token of friendship of the German people. From 1881, after it had been properly inscribed with Chinese ideographs, it was rung daily by the priests, but in 1900 it was taken by the foreigners and placed in Victoria Park, where it served as a fire signal. Again, in 1921, to make room for a war memorial, the bell was returned by the British to the Chinese and reinstalled in the temple, this time as a remembrance of the good will of the British community in Tientsin!

The memory of General "Chinese" Gordon, of Taiping Rebellion fame, is perpetuated in Gordon Hall, one of Tientsin's most imposing buildings. It was General Gordon who drew the plans for the original British Settlement; and the hall, which rises opposite Victoria Park, houses the British municipal offices, the public library, and an entertainment hall.

Across the loop of the Gulf of Pohai, at the southern tip of the Liaotung Peninsula, is Dairen, boom town of Manchuria (618).

On this rocky finger that points down to Shantung, the Chinese built fortifications less than half a century ago. In 1894 Japan came to arms with China over Chosen (Korea) and won the right to the Liaotung. But Europe rose to protest; Japan bowed and departed. Russia, financier to China, reaching out for an ice-free port in the Far East, won the lease.

Overnight, by the magic of the Tsar's command, Dalny (now Dairen) was born. In six years Russia spent 20 million rubles on the project, and Dalny mushroomed to

Photograph from the London Electrotype Agency, Ltd.

PRANKISH TIDES LIFTED THIS VESSEL INTO A STRANGE DRYDOCK

After anchoring safely in Amoy at night during an extremely high tide, the crew found themselves next morning perched precariously on this rock, 20 feet above the receding waters. They are sitting beside their stranded junk, patiently awaiting the next high tide to float it again.

greatness, guarded by Port Arthur (Ryojun).

In 1904-5 new history was written by gunfire; Dalny changed hands and became Japanese Dairen. Again it grew, and later the finger beckoned Shantung's peoples to migrate. By thousands every day they came to join in the mighty agricultural invasion into Manchuria lands, where prosperity rode in the guise of soy beans and other farm products.

Dairen prospered. To-day along its wide streets that radiate outward like spokes in a wheel are the fine buildings of commerce; in every way it is a modern, prosperous city.

To-day the three northeastern provinces and Jehol fly the flag of China's former emperor, Pu Yi, whose new reign here is to be designated under the dynastic title of Kang Teh, meaning "Peace and Virtue." From Chinwangtao to Antung is Manchutikuo coast.

Striking are the changes that have taken place along the China coast since the *Empress of China* nosed into Canton harbor.

Here patches of France, Portugal, Great Britain, Germany, and Japan have been grafted onto the former historic Cathay and have produced their blooms. To-day the native stock, bursting with energy, is thrusting out new and vigorous growths.

Photograph by F. Villegas Aramayo

HIGH IN THE TOWERING ANDES MEN DIG ORE TO COAT TIN CANS

For nearly six years the author made her home in a tent here (one of the group at the lower right), at the Pongo base camp for large-scale tin mining, and had opportunity to study strange fiesta customs surviving among Indian laborers in the mountains. The camp lay in a sheltered, glacier-carved valley of the Cordillera de Quimsa Cruz, so far above the sea (nearly 12,000 feet) that only scrubby plants and grasses would grow. The small stream eventually reaches the Amazon.

BOLIVIA, LAND OF FIESTAS

By Alicia O'Reardon Overbeck

Author of "Freiburg—Gateway to the Black Forest," in the National Geographic Magazine

FIESTAS are the very heartbeat of Bolivia, that South American land of contrasts, where in a few hours a mule can carry you from perpetual snow to perpetual summer, from arid sand wastes to steaming tropical forests, from modern cities to primitive farm communities whose organization goes back to the dim pre-Inca days.

When the Spaniards, headed by Pizarro, climbed over the Andean wall and dropped down into the heart of the Inca country, they found a highly developed nation, with its own elaborate religious observances. The conquerors superimposed on these pagan rites Christian ceremonies, and it is interesting now to trace the curious combination of pagan survival and rather warped Christian ritual that has emerged in the form of fiestas; for practically all Bolivian fiestas, save the *Seis de Agosto* (Sixth of August), the country's Fourth of July, are of religious origin.

I had opportunity to watch these fiestas, because for nearly six years I lived, with some twenty other "gringos," in a lofty, isolated mining camp (base for a large tin mine), situated in one of those deep, narrow valleys that gash the eastern side of the Cordillera Real, or principal range of the Andes (see map, page 649).

To the west lay a mountain wall 15,000 to 19,000 feet high; to the east was the impenetrable jungle of the Amazon Valley—barriers which cut us off from our own world and shut us in a strange and primitive world of people whose thin veneer of European culture belonged to a civilization long dead.

My introduction to the fiesta of *Carnaval* (Carnival), which precedes Lent, occurred shortly after my arrival in Bolivia. We gringos were invited to spend fiesta at the mine camp, which lay more than 15,000 feet up in the mountains, close to the line of perpetual snow.

To get there, we had to "change cars" several times. We started on muleback (mules are used in the altitudes rather than horses because of their greater endurance) over a narrow trail that climbed steplike up glacial terminal moraines, beside a stream that hurtled down to join the Amazon (see illustration, opposite page).

Sheep, guarded by dirty children, grazed on the stubby grass that grew on the rare level stretches. Potatoes and okra flourished in the small fields, surrounded by stone walls.

Occasional thatched huts, each topped by a canting cross, stood close to the trail, and from their doors, through which seeped that curious Indian smell of smoke and grease and dampness and unwashed bodies, people watched us pass.

Three or four black dogs ceased worrying the carcass of a fallen llama and ran snarling at the heels of our mules.

MOTORING IS PRECARIOUS IN THE HIGH ANDES

After less than an hour we arrived at the company mill. Here ore from the tin mines was brought by an aërial tramway five miles long, and here it was concentrated to 60 per cent tin before starting on its long journey to Liverpool, there to be converted from oxide of tin to the metal tin which coats our so-called tin cans.

From the mill the men were accustomed to traveling to the mine in the open buckets of this ropeway, but we women were stowed in the official automobile for the next few miles, while the mule drivers took our animals cross-country.

Motoring in the high Andes is not fun. The road from the mill wound round and round an almost perpendicular mountain. Water splattered down walls of glistening black slate and spumed across our path. Below us lay giddy, shadowed drops, and in February, the equivalent of our August, the mud was deep and slippery.

Mules are better for this kind of travel; so I was glad when the road dwindled to a thread of a trail and I was again on my mule and jogging upward.

We stopped at the pass which led from our valley to the one in which lay the mine camp to breathe the mules and to hammer life back into cold-stiffened fingers. Even close to the Equator, at 16,000 feet the cold cuts into one's vitals like a keen rapier; but aside from this discomfort, none of us was affected by the altitude.

Over our heads the aërial ropeway buckets passed, the ascending ones empty, the descending ones brimful of ore. Up from the Choquetanga Valley, which spread below us, rolled giant masses of wind-torn

Photograph by E. E. Buchler

ONE OF THE UGLIEST CARRIES A HARP

The celestial instrument, a small, primitive version, contrasts strangely with the mask's satanic, staring eyes and huge, protruding tongue. Most of the costumes, such as this one seen at Oruro, are Indian-made.

cloud mist, out of which, like gleaming islands, appeared and disappeared the snowy heads of lofty Andean peaks.

We single-filed gingerly down the glassy trail, the animals sliding on the ice-coated rocks, to a point where the trail appeared to end. Then, swinging around a jutting shoulder of snow-veined granite, we entered a cirque surrounded by glaciers and sharp, white-crested peaks that rose to 18,000 feet and more. At its bottom lay a rippleless, jade-green lake.

By the shore, on the only piece of visible flat ground, was the mine camp—three stone buildings (the office, staff house, and store), half a dozen canvas tents grouped about a cobbled patio, a corrugated-iron hospital and schoolhouse, a corral, and a row of thatched native huts made of stone and mud.

Everywhere was stark desolation; only the huge mounds of loose, gray rock, the menacing spires of dull-gray granite, the snow, and the unfriendly green lake. But it was camp, and here we remained in comfort for a week, celebrating the fiesta of Carnaval (see text, page 645).

LIQUOR AND DYNAMITE ENLIVEN THE FIESTA

Carnaval is supposed to start the Sunday before Ash Wednesday, and the company rule is that the miners must be back on the job Thursday morning. As a matter of fact, festivities are usually in full swing by Saturday afternoon, and sometimes they drag out for an entire week. The company makes donations of money, liquor, and dynamite, and is also obliged to make certain concessions for the occasion.

Normally, our mine camp was dry. But by sundown of the Saturday before Carnaval traveling merchants were yammering for admission, and by the next sunrise the mule trail which was Main Street was lined with booths and makeshift stalls, where bottled beer, raw alcohol made of sugar cane, *pisco,* or grape alcohol, and *chicha,* a drink brewed from grain that has been chewed, spat out, and left to ferment in the sun, were peddled.

These merchants also did a roaring business in a concoction of sun-dried sheep, onions, and fiery red peppers ground into a paste; pigs roasted whole and looking uncommonly natural; boiled *chuño* (potatoes which have been frozen, trampled free of water, frozen, and trampled again and again, until they are little balls of pure starch); and stacks of golden Bolivian meat pies and grayish native bread, not to mention an assortment of drygoods and hardware from Germany—shawls, skirts, blouses, shoes, the omnipresent white enamel ware, celluloid dolls, glass rosaries, pocketknives, and the like.

The official celebration was meticulously launched on Sunday morning by the presentation to the mine superintendent of the *Achura,* or annual good-will offering of high-grade tin ore which the miners had pilfered during the year from the stopes.

First, from the corral came half a dozen sad little burros, bedizened with gaily col-

ored saddle cloths and twined with serpentina. Each animal was led by a section captain attired in his best, and each bore on its back two sacks of ore, the achura.

The actors in this naïve little comedy ranged before us; the sacks were taken off the burros' backs and placed at the superintendent's feet. Then each captain, on behalf of his section, made a speech of such fervor and intensity that the orators themselves were moved to tears; and the superintendent replied with as much enthusiasm as if he didn't know precisely where the ore came from.

Toasts were drunk to North and South America, to the United States and Bolivia, to the Boss, to the ladies and the gentlemen. The affair concluded with a general shaking of hands and an exchange of embraces, and Carnaval was officially under way.

IMPORTED BAND VS. LOCAL TALENT

Music is the keynote of all Bolivian fiestas, and our miners, particularly affluent at this time, had brought in a professional band from Oruro for $300 gold. This band earned its money, since it played practically without ceasing for four days and four nights, with a splendid disregard of local talent. For each mine section, too, had its own particular band, usually made up of players of drums and home-made reed pipes, that settled in nooks and corners of the patio and along the seething Main Street.

Without raising an eye toward the haughty imported artists, it played, over and over, the queer, reiterated, tripping music of the land, which, like the trill of a canary, never seems to reach a consummation.

To this music, broken at intervals by the dynamite explosions, the natives danced day after day. The tropical sun and the tramping of many feet reduced the snow in the patio to black mire, but no one seemed to care. Round and round they swung.

The Cholo (half-breed) miners wore their ridiculously severe best suits of black; their women were resplendent in bellying skirts of pink and green, mauve and blue, with embroidered shawls of contrasting colors, elaborate high-heeled kid boots, and the characteristic straw Chola topper.

Indian men wore homespun pants, rawhide sandals, striped ponchos of beautiful somber blues and greens and reds, and knitted caps with long earflaps, surmounted by immense round, white-felt hats; Indian women were frowzy and bedraggled in wool skirts, sandals, native wool shawls of rusty orange and heavy purple, and little hard felt hats. Children, dressed exactly like their elders, were everywhere, popping in and out among the dancers, harassing the bands, stealing titbits of food or drink where they could.

Photograph from Alicia O'Reardon Overbeck

A FAINT ECHO OF ANCIENT INCA POMP

His elaborate fiesta regalia, with crown, scepter, and ornaments of coins, hints of the golden glory of the age before the Spaniards came. The Aymarás were subjugated by the Incas long before the Spanish conquest.

Most of the women had babies in the blankets knotted around their shoulders, and the unfortunate infants bobbed up and down as their mothers twirled and bounded through the boisterous measures.

Some of the young bloods had hired costumes from La Paz or Oruro and were

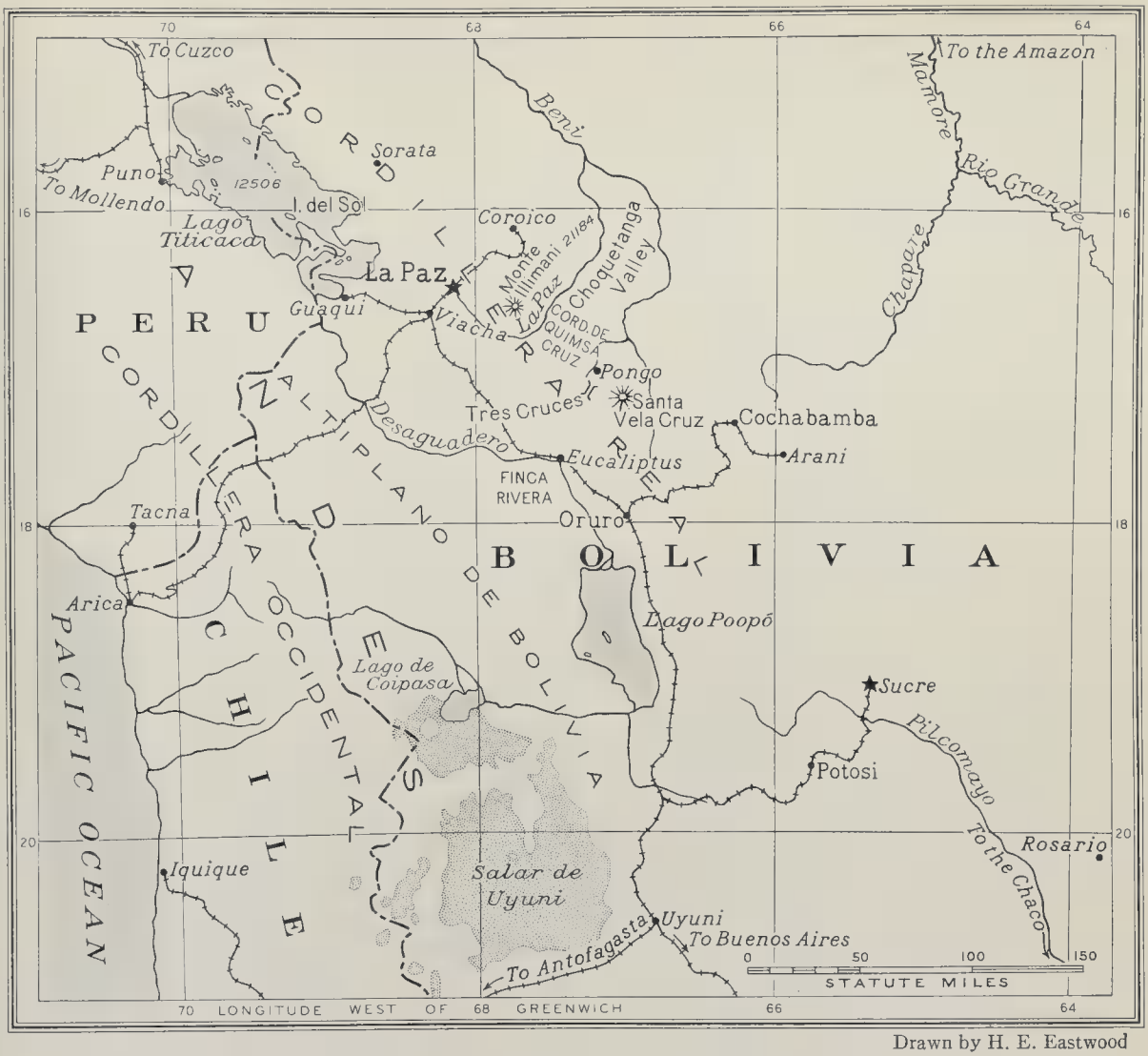
A DYNAMITE-CARVED AUTOMOBILE ROAD CLIMBS GIDDY ANDEAN HEIGHTS

To the author a sure-footed mule was preferable to a motorcar, sliding and groaning around the curves of the rough track that ran halfway from the mill to the mine (see text, page 645). The snow-capped mountain in the distance is Santa Vela Cruz, the southernmost peak of the Cordillera de Quimsa Cruz.

Photographs by F. Villegas Aramayo

THE DEVIL ACTS AS MASTER OF CEREMONIES

With pitchfork in hand he stands at the left and watches over one of the distinctive Bolivian native dances. At the right a visitor, Celia (see text, page 651), joins in the dancing at the invitation of the natives, for at fiesta time Bolivia shows its true democracy. Sun designs, worked on the costumes, recall ancient pagan rites, now curiously combined with Christian ritual.



Drawn by H. E. Eastwood

ON BOLIVIA'S ROOF, AMONG THE ANDES, THE AUTHOR FOUND FIESTA-LAND

At a mining camp in the Cordillera de Quimsa Cruz she watched Indian laborers in gay carnival. At the Finca Rivera and elsewhere on the high, windy plateau she saw somber-eyed Aymará Indians, in age-old rites, pay homage to their dead (see text, page 651). Constitutional capital of the Republic is Sucre, named for Simón Bolívar's able general, but La Paz, more than two miles above the sea, has long been the actual seat of government. Lofty Lake Titicaca, on the Peruvian border, is approximately half as large as Lake Ontario.

ruffling around in beaded trousers, satin capes, little leghorn hats with ostrich plumes and long ribbon streamers, jute wigs and whiskers, and masks.

One group wore false faces that particularly intrigued me—pleasant, Germanic faces, with mild china-blue eyes, pink cheeks, and widely smiling mouths that disclosed rows of gold and silver teeth.

GRINGOS JOIN IN THE FUN

As the fun grew wilder, we gringos were called out to join in the dancing. We went not only because we liked it, but because it was something of an obligation; for at fiesta time Bolivia knows true democracy, and the meanest Indian feels he has a justifiable grievance if the most elegant aristocrat refuses to dance or drink with him.

So, although dancing at an altitude of nearly 15,000 feet, in riding boots, on slippery cobbles, and with a partner of uncertain merit, might come under the head of hard labor, we gayly joined the laughing, shouting crowd, danced with them, and solemnly accepted a pull at their proffered beer bottles or exquisite little cups of hand-beaten silver filled with pisco.

Confetti flew in feathery showers, and whizzing strings of serpentina wound round and round us. Tiny bags of flour, followed by eggshells filled with a particularly vile perfume, buzzed through the air and plastered our faces, hair, and clothes with dough.

Photograph from Ewing Galloway

INDIAN BRAVES WEAR SKIRTS ON THE ISLAND OF THE SUN (ISLA DEL SOL)

Effeminate-looking feathered hats add to the illusion that women make up the nearer group of fiesta flute players. Actually, most of the dancing is done by men, and theirs is a special costume favored in this center of ancient sun worship. Members of the farther group wear ocelot skins. In the distance are the waters of Lake Titicaca, highest steam-navigated lake in the world. Across it comfortable steamers ply between Bolivia and Peru (see map, page 649).

Finally, a halt was called, and the workers streamed off to the office, to stand in line at the pay window while the company gift was distributed. This gift never changed its character during the years I was in Bolivia. Invariably it was a gaudy, printed cotton handkerchief filled with pink and white sugar candies rolled round caraway seeds, a package of confetti, several bundles of serpentina, and a small bottle of Florida water.

CHRISTENING AN ANNUAL EVENT

Fireworks, too, punctuated the dancing. But, with all these worldly snares, religion was not overlooked. A priest was always brought in, even though his fee cut distressingly into the music and fireworks funds, and the year's crop of babies was christened and the year's crop of lovers married.

With perfect good will and no one's feelings hurt, the Pacha-Mama, too, received her dues. The living sacrifice to the Mother Earth is one of the most curious survivals in Bolivia of an ancient custom and one in which we gringos did not participate.

I know only from hearsay, therefore, that a bull, which the workers thriftily insist on the company's providing, is driven to the portal of each mine and killed by a blow between the eyes. The heart is cut out and the blood is squirted into the mine and over the rocks at the portal. The animal is then skinned and the meat parceled out to the people. This sacrifice is supposed to appease the Pacha-Mama for metals taken from her during the year, and to obligate her to prevent mine accidents, as well as to produce plenty of rich ore and a smashing crop of potatoes during the coming season.

Later, if accidents persist or the mine production drops off, the company, despite its donation of six or seven bulls at Carnaval, is called on for a number of white llamas,

which are offered up to the temperamental Pacha-Mama.

So the fiesta days fly by. Comes Thursday morning. The hired band, weary, dirty, but cheerful, tootles down the long trail home. The merchants, herding before them their burros, noisily set forth for other, if lesser, fiestas. The native bands, still musically inclined, scuttle from point to point, trying to evade the eagle eye of the mine superintendent, who is bent on ridding his domain of outsiders and getting his men back on the job.

Slowly life shakes off its mantle of confetti and serpentina and emerges bare and drab. And the great fiesta is over.

ALL SAINTS—A FIESTA OF AND FOR THE PEOPLE

Carnaval and the Seis de Agosto, both celebrated in much the same manner, are not entirely unique. Carnaval is observed with some variations around the world, and there are few countries left without their Liberation Day. The Bolivian fiesta that is purely of the people and for the people, the fiesta which a gringo must approach reverently, if at all, is *Todos Santos* (All Saints), the feast of the dead.

When my first November in Bolivia rolled around, I was staying at the company staff house on the *Altiplano,* the highland plateau lying between the east and west ranges of the Andes (see map, page 649). It has an average elevation of about 13,000 feet and a width of 50 to 100 miles; topographically, it consists of wide, flat plains and low, rolling hills. The International Railway, which connects Buenos Aires on the southeast and Antofagasta on the southwest with La Paz, runs through this pampa land.

Most of the region is desolate, with nothing but scant patches of tola brush, ichu grass, and occasional scrubby fields of barley, potatoes, and quinoa. In the part which I know best the few inhabitants (the population density is less than eight to the square mile) are shepherds or small farmers, living in villages on huge free holdings, or *fincas,* under a system of laws that must have been in existence long before the Inca Empire reached its zenith.

The customs of these people are very different from those of our miners back in the hills; so I was delighted when Billy, the young Scot in charge of the company hauling, came to my room on the eve of the fiesta and told me that Claudina, the cook, had invited us to her house.

"She's staging some sort of a show," he said irreverently, "and wants us in on it. Celia will tell you about it."

Celia was the chatelaine of the house, as well as doctor, nurse, and counselor to every native for miles around. Through the open kitchen door I could see Claudina, strangely unreal and important in a black skirt and shawl. Around her were grouped three other house servants, dressed in their gaudiest and best.

"You see," Celia explained, "both the father and mother of Claudina's man died last year, and it's the custom to have a special ceremony in the house on the Todos Santos immediately following a death. This is a very solemn affair, to which only well-loved outsiders are invited; so tread lightly."

We stepped out into the crazy wind that forever blows across the Altiplano, the kitchen party at our heels. Down a dark, tunnel-like alley, flanked on either side by blank adobe walls, we went until we came to an open door, through which flickered a wavering light.

"Enter, Señor y Señoras." Claudina ushered us down a single step into the room which was her home.

At first glance there was something macabre, almost sinister, about the still, small place, with its tremulous candlelight and its dominating crucifix shrouded in black net, through which the Figure gleamed waxen. There should be an open coffin, I felt, and the stagnant sweetness of funeral flowers, and mourners who covered their heads and wept.

ANCIENT RITES HONOR THE DEAD

But there were none of these. Claudina's man; his brother, the night watchman; and a shriveled, bent little old man in a scarlet poncho rose with composure and shook hands with us. Then the old man, with gentle courtesy, made an address of welcome, partly in Spanish and partly in Aymará, explaining that it was the custom in Bolivia to honor the lately dead. He waved his hand with a large gesture that embraced the extraordinary scene, and my first feeling of awe slipped from me.

For, examined critically, the room was more like a rather elaborate delicatessen than a funeral chamber. Against the wall

Photograph from Willard Price

PROUD SCION OF A CONQUERED RACE

A fine type of Aymará Indian at La Paz pauses for a moment in the dance. A big fiesta headdress of feathers is fastened under his chin. His cheekbones are high, his skin copper-colored. The Aymarás are generally darker, shorter, and less mild in nature than their neighbors, the Quichuas.

opposite the entrance door and under the crucifix was a sort of altar on which burned six candles. On either end of it were two large images of nicely browned bread, one a man in Cholo costume, the other a woman in a high hat, a shawl, and an immense skirt. Around these figures were groups of spirited bread animals — llamas, burros, dogs, and possible lions.

In front of the altar were two kitchen tables, set side by side and spread with purple and black crêpe paper. On them were arranged strange, pathetic offerings of love — a pineapple, a bunch of somewhat mangled bananas, oranges, bread baked in numerous shapes, tins of sardines and peas, a package of wax candles, a skein of blue wool, a spindle, little cakes, reed pipes, and a mound of coca.

Several bottles of beer lay on each table, and glasses of chicha and pisco were scattered among the food. It was so warmly human that I felt hot tears smarting under my eyelids. But the formalities must be observed.

"It's very beautiful, Claudina," I said, and we exchanged a stately embrace.

"We must say a prayer for old Tomaso and María," whispered Celia.

So with bowed heads and closed eyes we sped our good wishes to those two souls who had fared forth into the unknown. Then we politely drank a glass of beer and ate a few cakes, shook hands all round, and stepped into the night.

STANDING GODMOTHER TO A BREAD BABY

Later, as we settled down by the staff-house fire, Billy said: "Did you know you were going to be asked to stand godmother to Claudina's baby?"

"I didn't know Claudina had a baby." The impending honor wasn't good news, as the godmother in Bolivia assumes definite duties, such as providing the christening garments, sending gifts to both baby and parents, setting up the christening party to meat and drink, and paying for the gravestone and coffin should the child, as is often the case, die.

But the kitchen door was opening and Claudina, holding in her arms a bundle swathed in flowing, embroidered robes, was advancing. Behind her solemnly stepped the other servants and several friends.

Photograph from Ewing Galloway

INDIANS DANCE IN OSTRICH-PLUME HATS AS TALL AS THEMSELVES

A source of supply is available near at hand, for the American species of ostrich roams the deserts of southern Bolivia. To make these headdresses seen at Rosario, a bamboo framework is fastened to the hat and a large bamboo hoop separates the plumes of the top to form a feathery circle five or six feet in diameter.

Photograph by F. Villegas Aramayo

HERE THE WELL-DRESSED NATIVE WEARS A MASS OF FLOWERS ON HIS HEAD

Fiesta fashion in parts of Bolivia's high plateau calls for flowing white robes, large floral headdresses, and long reed pipes for music. In some villages the hats are huge and are trimmed with really beautiful ostrich feathers dyed brilliant colors.

Photograph by F. Villegas Aramayo

THE BRASS BAND BLARES, THE GRAND MARCH STARTS—IT'S FIESTA TIME AT A TIN MINE IN THE ANDES

Indians whose ancestors fought the Incas and the Spaniards labor stolidly in the white man's mines until the frequent fiestas. Then, with music, drink, dance, and dynamite, they quit work and celebrate (see text, page 646). Musicians brought from Oruro toot their hardest as the procession moves along Main Street, lined with makeshift liquor booths and stalls. The General Manager and Chief of Police are at its head, followed by the gringo engineers, office staff, high-class Bolivians, *Cholos* (half-breeds), and Indians. The banner of the district school is borne in the van.

"OLD NICK" HIMSELF BRANDISHES AN UMBRELLA

It looks like rain and the Indian under the horns and hair is taking no chances of getting his elaborate Carnival costume wet on the way to the church at Oruro. Incidentally, he has not bothered to remove his spurs. In such outlandish costumes as these the dances are carried on for three days and two nights, or longer.

Photographs by E. E. Buchler

NOW THE TOWN IS FULL OF NIGHTMARES!

Here comes an evil spirit on his way to church, of all places. Take off the horrendous mask with its horns and, lo! it's just an Indian miner of Oruro having his fun, as his ancestors have had for generations. He bears a shield and a scepter somewhat like a pitchfork, and blazoned on his stomach are the points of the compass.

Photograph from Ewing Galloway

ALL DRESSED UP FOR A CARNIVAL

A young Aymará living near La Paz wears the skin of an ocelot and a "high hat" which should be an inspiration to the modern milliner in her quest for "something different." Lovingly he fingers his flute, and crosswise, beneath his stiff fur "vest," he carries another of different pitch.

"Señora," said Claudina, stopping before me, "would you do me the grand favor of becoming godmother to the baby and giving it a name?"

Thoroughly nonplussed by the suddenness of the attack, I could only weakly bow assent. Then Claudina laid the bundle in my arms, and to my horror I found it had practically no weight.

Seriously she turned back the robe, and I saw that I was holding an oval, slightly convex loaf of bread, about 25 inches long and 10 inches wide, made in the form of a baby! The face and hands, nicely modeled, were of cooked but not browned dough, and the glossy, well-baked body was decorated with animals and scrolls and little colored candies.

"You will give the baby a name?" asked Claudina anxiously. I saw that this was no joke and hurriedly replied:

"I shall name the child Alicia." I was too flustered to think of any other than my own name. Then I gazed sternly down into the bland bread face in what I hoped was a professionally clerical manner and returned the child to Claudina.

"Many thanks, Señora." She replaced the robe over the bread baby and the party withdrew.

"What does it mean?" I asked Billy.

"I tried to pump Claudina," he replied, "but all she would say was, 'It is the custom.' I have heard of the bread baby, though, outside Bolivia. A man from Ecuador told me it was a regular part of the Todos Santos ceremonies there, and that the invitation to be godmother was a great honor.

"But as long as you're interested in this Todos Santos business, suppose you drive with me to the Finca Rivera to-morrow. It's a terrible trip and we'll have to go over unbroken pampa part of the way, but that's where you'll see the real Bolivian fiesta.

"Do you know that the finca is twenty square leagues in area and practically self-contained? Everything is made or grown on the place except some sugar, coca, and alcohol. They raise their wool and weave it into cloth for their clothes; they make their felt hats and hide sandals; they build their houses out of adobe bricks they themselves make; they grow the barley and potatoes and mutton that they eat.

Photograph by Academy of Natural Sciences of Philadelphia

NOT A WAR DANCE, JUST ANOTHER CELEBRATION

Stiffened skins of ocelots or jaguars, worn poncho-fashion over the shoulders, add a wild touch to the festive costume of these Aymarás, frantically dancing and blowing their flutes at Eucaliptus.

Photograph by José N. Piérol

FINE FEATHERS MAKE FINE FESTIVALS

Most prized for holiday adornment are ostrich plumes dyed blue, pink, green, purple, or flamboyant cerise. False whiskers and wigs, in evidence here, were worn originally by the smooth-faced Indians to imitate and ridicule the early Spanish invaders. The man at the right wears a false face, complete with spectacles and gold teeth.

"Up to 25 years ago it was a community just as it was in the Inca days; but the Rivera Indians are Aymarás, and they were always quarreling with their Quichua neighbors; so they finally put themselves under the protection of Colonel Pando, at the time President of the Republic. Shortly after the transaction the Colonel was killed, and since then the property has changed hands several times; but its boundaries are the same and the old finca law is still observed.

"The head of each family has his little farm, which he works for himself; but he is obliged to give to the owner, on demand, six days' work to each three he puts on his own farm. There is never any money exchanged. The owner gives the worker a certain amount of coca and alcohol and nothing else. If an Indian dies without leaving a family, his land and herds go back to the finca. Of course, these laws are purely Indian laws, but they are recognized and respected by the Republic; and nearly all Indian uprisings have been caused by infringements of them."

I was up next morning with the sun, and by eight we were under way. Although it was the first of November, there had been no rain, and the road was as dry and white as if it had been sprinkled with talc. Every once in a while a mirage shimmered before us.

We crossed the amber-brown Desaguadero River, which connects Lake Titicaca with Lake Poopó, over a shaky plank bridge and scuttled through a deserted pueblo, beyond which the road was hardly more than a track. We followed it until it tapered off into occasional broken ruts. Before us stretched an empty, wind-swept plain, flat and smooth and bare as a floor.

SEVEN VILLAGES ON ONE "RANCH"

"We're on the finca now," explained Billy. "The Desaguadero is the boundary on the right. There are seven villages, all more or less alike; but we'll go to the largest, where the owner lives."

We followed the broken trail, in places marked only by huge mounds of tola brush, baled for exportation. Aside from llama droppings and *yareta*, a highly resinous, mosslike plant, tola is in many parts of Bolivia the only fuel and one of the fincas' few means of revenue.

Occasional flocks of sheep grazed on the scant bushes and the dry gray moss that grew on the powdery, reddish earth. They were guarded by barefooted women and girls in dark wool skirts and blouses, wide red belts that extended from the hips well up under the breasts, shawls of warm-colored cloth, and small felt hats. As the shepherdesses followed their flocks, spindles twirled incessantly in their hands.

Llamas, too, found pasturage on the sterile pampa. Their keepers were mostly half-grown boys in bright-striped ponchos and wide-brimmed hats, who drew thin music from small reed pipes. In their unoccupied hand they usually held a sling.

LIKE DAVID, THE INDIANS USE SLINGS

"All the Indian fighting," Billy said, "is done with stones and those slings. I think they must be the same kind that David used on Goliath. The Aymarás are deadly shots and can create almost as much havoc with their slings and rocks as the soldiers can with their guns."

Here on the pampa the Indian dwellings were of a different type from those of the pueblos. They were round, beehive affairs, made of adobe brick, and looked rather like the igloos of the Eskimos. They had no windows, and their only entrance was a small doorway so low that a child would have to bend to get in.

On we went, stopping now and then to listen, until at last on the wind came a faint, shrill scream and dull, broken thud.

"There," said Billy, "that must be the music from the pueblo. It can't be far now."

Five minutes later we drove into a pueblo, one much the same as a hundred of its kind in Bolivia.

The church, large out of all proportion to the rest of the buildings, was of the simple basilica type, with buttresses made of piles of stones and adobe, and a single bell tower to one side of the central door.

The house of the owner was a shapeless, one-storied edifice that rambled around the four sides of a big patio. Rows of thatched huts were guiltless of either windows or chimneys, and there was an immense round community oven, almost as large and much the same shape as the igloo dwellings of the pampa. Everything was made of adobe, all the curious faded, pinkish-ocher hue of the surrounding country.

The music was almost intolerably close, but we could see no people; so Billy tooted

Photograph from Ewing Galloway

FESTIVE INDIANS LIKE PLENTY OF PLUMES

These natives at Sorata, Bolivia, would wear a gross of ostrich feathers apiece if they could get them. Some of the dancers carry huge sunshades of plumes in their hands and others wear them on their heads in enormous bamboo and feather hats (see illustration, page 653).

his horn. A young man came out of the wide door of the main house and greeted us with stately politeness. He was the owner of the estate, a high-class Bolivian, educated, intelligent, and charming.

"The workers are in the cemetery," he said. "Would you like to have a look at them? You'll see the Aymará Indians here as they were two, three—who knows how many hundred years ago?

"Our people seldom leave the finca, even to go as far as the railroad, and they know practically nothing of the outside world. They are supposed to be Christians in good standing, but their ritual is a little mixed. They make their regular blood sacrifices to the Pacha-Mama (see text, page 650) and to the sun and moon as well, and in many ways they are very different from your mining-camp natives."

He was right. The predominating type in our district was Cholo; here the people were Indians, pure and simple—lithe, somber-eyed men with a peculiar oriental cast of feature, who stepped lightly on naked feet over the rough, sun-baked ground; sagging women with matted braids and stupid, vacant expressions; slim boys and girls with smooth, rather pleasing dish faces; children with dirty noses, frowzy heads, and ragged clothes.

RICH COLORS OF VEGETABLE DYES

Even the color scheme was markedly different. The Aymarás use vegetable dyes and spurn the more raucous hues adored by the Cholos. From the scant vegetation of the pampa the natives have developed at least 18 distinct colors. In the finca cemetery there were no cerises, no apple greens, no screaming purples; instead, dull, deep reds and rich, thick blues and greens and yellows, all imposed on backgrounds of black and white. The total effect was that of a Persian rug—warm, subdued, harmonious.

No ostentation marked the finca graves. There were only two small adobe monu-

ments and no crosses—simply rows of raised red mounds, covered now with what food the relatives of the dead could spare from their scanty store. Over one of the graves, however, a sort of market stall had been erected, and this seemed to be the central point of the whole celebration. About it milled the greater part of the crowd, and hither the owner guided us.

"It's for the people who have died during the past year," he explained. "The men in charge are the sons of the dead."

Compared with this opulent display, Claudina's exhibition seemed pitifully small. At the head of the stall was a large black wooden cross, from which swung bells that jingled noisily in the rising wind. From the right arm of the cross flew a long black streamer, not unlike the crêpe we are accustomed to place on front doors when there is a death in the house.

Below the cross stood a repulsive sheep. Except for its head and the tip of its tail, it had been skinned and sun-dried. The flesh was a dull, purply color; the woolly head, with its staring eye sockets, was turned to give the animal a sprightly, realistic look, and the tail was bent at a jaunty angle.

Had this animal, I wondered, any connection with the Christian conception of the Lamb? If so, it was in queer company, for all around it were hearty pagan offerings: huge quantities of potatoes strung on cords and arranged in festoons; okra, chunks of meat, grain, round, grayish goat's-milk cheeses; coca, chuño (see text, page 646); bread baked in the form of animals; sugar cane, and onions with green stalk and flower complete.

On either side of the stall crouched the orphaned sons, clad in black pants, black ponchos, and black hats. Those on the left presided over huge mounds of onions and bread animals; those on the right were in charge of an earthen ewer filled with pisco (p. 646) and a row of small, hand-wrought silver cups. They cried their wares in loud, monotonous tones, and the people pushed and scrambled for the spoil — a stalk of onion and a bread animal or one of the cups filled with pisco, given in exchange for a prayer for the dead.

Some conscientious natives, on receiving their gift, removed their hats, blessed themselves, and prayed aloud; others merely made a pass at their hats and breasts, then scurried around the back of the stall, quickly to reappear for more booty. One man got four bread llamas and a massive collection of onions, all of which he stowed in the bosom of his shirt; and his returns were scant and perfunctory, the merest shadow of prayers.

"What does it mean?" I asked the owner.

"Who knows?" He shrugged his shoulders. "I think the idea is that the souls come back, and as these people are themselves hungry half the time, they think that nothing would be so welcome to the souls as food."

"But what really becomes of it?"

"Perhaps they eat it; I don't know. They are very simple people. They are quite capable of eating it themselves and still believing that their dead have had it and enjoyed it. They're starting to dance now. Look!"

DANCING OVER THE GRAVE MOUNDS

Around the band of pipes and drums that played over and over again its nerve-breaking, monotonous theme, a group of men danced silently, moving in a circle and skipping unconcernedly over the grave mounds. Without a word several women linked arms with the dancers and fell into the thudding dog trot. The groups that had been squatting beside the graves, staring with lustful eyes at the food, rose one by one and joined the dancers.

Aside from the music, it was odd how little noise these people made. Save for the loud cries of the orphans on the stall, there was no outstanding human sound, no shouting, no singing, and no laughter.

"They'll keep up that dancing until they can't stand," said Billy, "or until all the pisco's gone. I hope the souls are temperate, for they'll get precious little to drink by the time their friends have finished."

As we strolled back to the pueblo, the owner grew talkative.

"Don't go away," he said, "full of pity for my people. In several ways they're as well off as many in your own country. They never have to worry. They'll always have a home; they'll always have enough to keep them from starving; they'll never be out of a job.

"As for their customs and religion," he continued, "they are rich in variety and apparently they satisfy. Isn't that enough?"

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A HALF MILE DOWN

Strange Creatures, Beautiful and Grotesque as Figments of Fancy, Reveal Themselves at Windows of the Bathysphere

By William Beebe

The deep-sea investigations of Dr. William Beebe, oceanographic naturalist, during the season of 1934, financed and sponsored by the members of the National Geographic Society, are described by the leader of the expedition, who this year successfully established a new depth record of 3,028 feet in Bermuda waters.

THE Bathysphere lived throughout the spring, summer, and autumn of 1933 quietly in the Hall of Science of A Century of Progress Exposition at Chicago. In this time half a million people thrust their heads within the narrow doorway and murmured, "Thank Heaven, we don't have to go under water in this!"

Being only an inanimate mass of quartz and steel, she would remain the static creator of vicarious thrills until the Hall of Science passed away unless some activity more potent than slow corrosion and rust was brought to bear.

THE CALL TO ACTION COMES

The summons came at the end of her year, when her paint was still undimmed, her quartz eyes steadily watching; it came to me in a letter saying that the National Geographic Society would be glad to sponsor a new dive.

Four years ago Mr. Otis Barton and I had reached and returned from a depth of a quarter of a mile,* and later we had made a still deeper dive. However, knowing that my interest in the work lay only in scientific observations, the National Geographic Society made no stipulation of a record.

Friendly arrangements were speedily effected between the National Geographic and New York Zoölogical Societies, and early in March the new expedition was well under way, the twentieth of my Department of Tropical Research and the sixth year of oceanographic work off Bermuda.

The large blue sphere was roused from her long reverie one day and hoisted upon a freight car. The next time I saw her she was squatting disconsolately amid an enormous jumble of intricate machinery, whirling belts, and flying sparks in a factory at Roselle, New Jersey. She had returned to the place of her birth for a thorough overhauling.

As the Bathysphere rested on her present bed of steel filings she seemed as staunch and sturdy as ever. I would willingly have scrambled inside and trusted her to carry me down and back safely to any depth I chose; but the doctors of mechanics, gathered in consultation, were more skeptical and they began to assemble what in human hospitals would be stethoscopes and sphygmometers.

* See "A Round Trip to Davy Jones's Locker," by William Beebe, in the National Geographic Magazine for June, 1931.

DAWN SILHOUETTES THE EXPEDITION'S "FLEET"

The tug *Powerful* tows the barge *Ready* through the narrow, winding entrance of St. Georges Harbor to the open sea for the unmanned test dive on August 7. The top of the Bathysphere shows on the forecastle of the barge, beneath the end of the boom. Coral formations and huge purple sea fans can be seen through the clear shallow water along the buoy-marked channel.

Photographs from Dr. William Beebe

THEY WITNESSED MAN'S DEEPEST OCEAN PLUNGE

The entire personnel, including the crew of the *Ready*, forgathered after the 3,028-foot dive August 15, six miles off Bermuda. The official staff, standing at the upper left, are (left to right): John Tee-Van, Jocelyn Crane, E. John Long, Gloria Hollister, William Ramsey, and Dr. William Beebe. Seated at extreme left is Otis Barton, Dr. Beebe's diving companion.

I peered in through the center window and it seemed as clear as ever, and then I was startled to see several radiating lines as from a fracture. I rubbed the glass, and a small spider ran over my hand, as at my touch the strands of cobweb disappeared. I left the experts to their intricate examination, and as I motored back to the city I laughed at the fright which the spider had given me and remembered that one of its relatives, the water spider,* could put to shame all of man's submarine efforts, whether with diving bells or Bathyspheres.

When I again visited the Bathysphere the physicians of inanimate things had made out a very bad case. The quartz eyes on close examination had shown a strange cloudiness, and minute fractures were visible to all eyes but mine.

No one but I would trust them again; therefore a test force was brought to bear—physical pressure—and the poor old lenses, which had so bravely withstood mighty loads of black water, cracked at comparatively low strains, about 900 pounds to the inch. Mr. Gerard Swope, of the General Electric Company, heard of this and generously ordered new windows of the finest possible material. The copper setting of the door and its central wing bolt of brass were found to be crystallized and had to be replaced.

When high officials of the Air Reduction Company viewed our old oxygen tanks and chemical trays and saw our palm-leaf fans for circulating air, they said such things were more or less contemporary with the Stone Age. They forthwith devised a most effective arrangement—four superimposed trays with a diminutive electric blower which changed and purified all the air in the sphere every minute and a half.

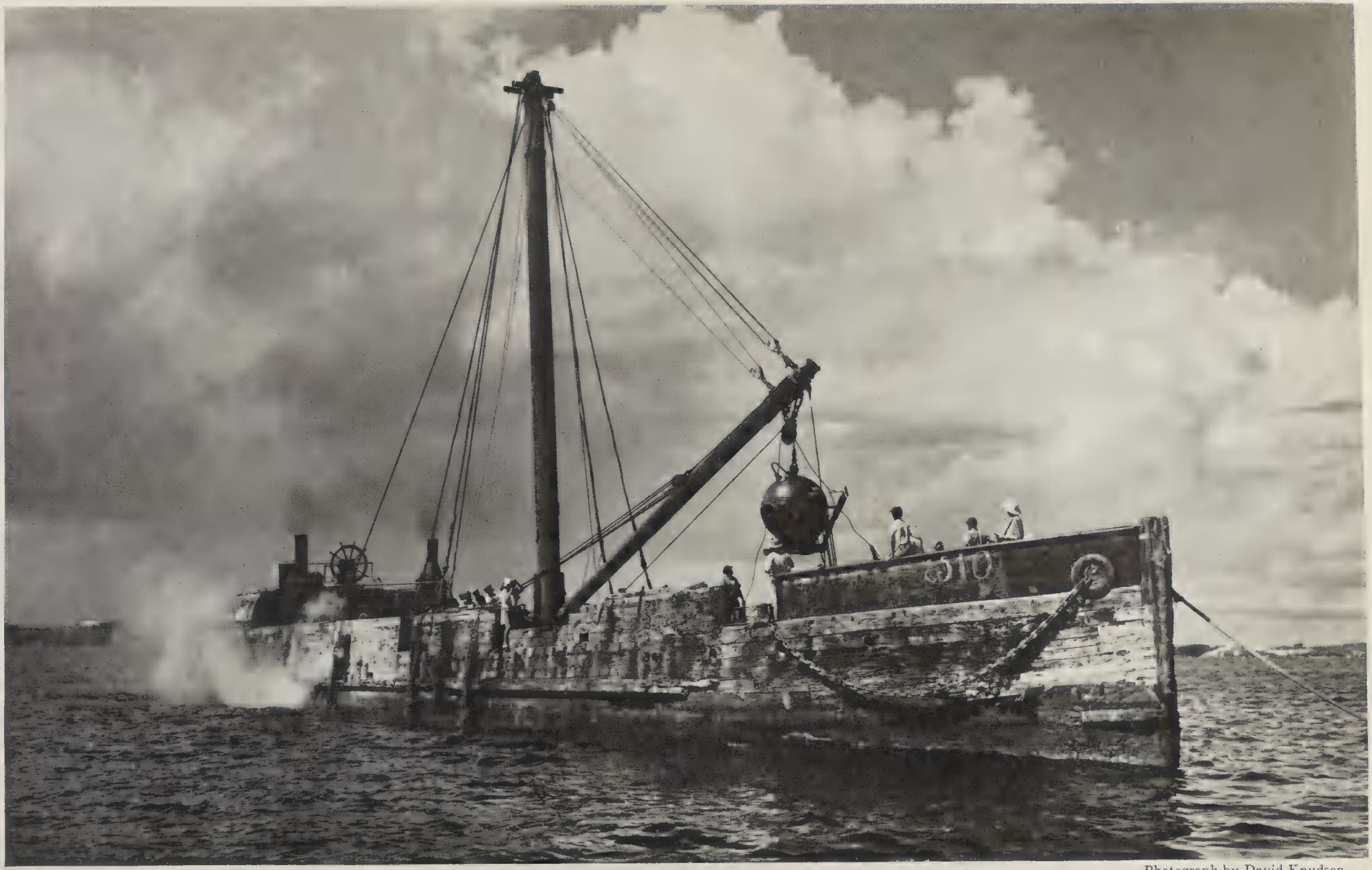
The old oxygen tanks were scrapped and new ones made to order and fitted with the latest thing in valves. Our former allowance of two liters of oxygen a minute was cut down to one, as quite sufficient. The visible gauge in the valve was a glass bubble which danced up and down in a tube,

Photograph by John Tee-Van

COLUMBUSES OF THE LOWER DEPTHS

Dr. William Beebe (right) and Otis Barton are back on deck after their world's record dive of 3,028 feet. The United States and the National Geographic Society flags, carried down on man's deepest plunge, are attached to the cable, as they were during the descent.

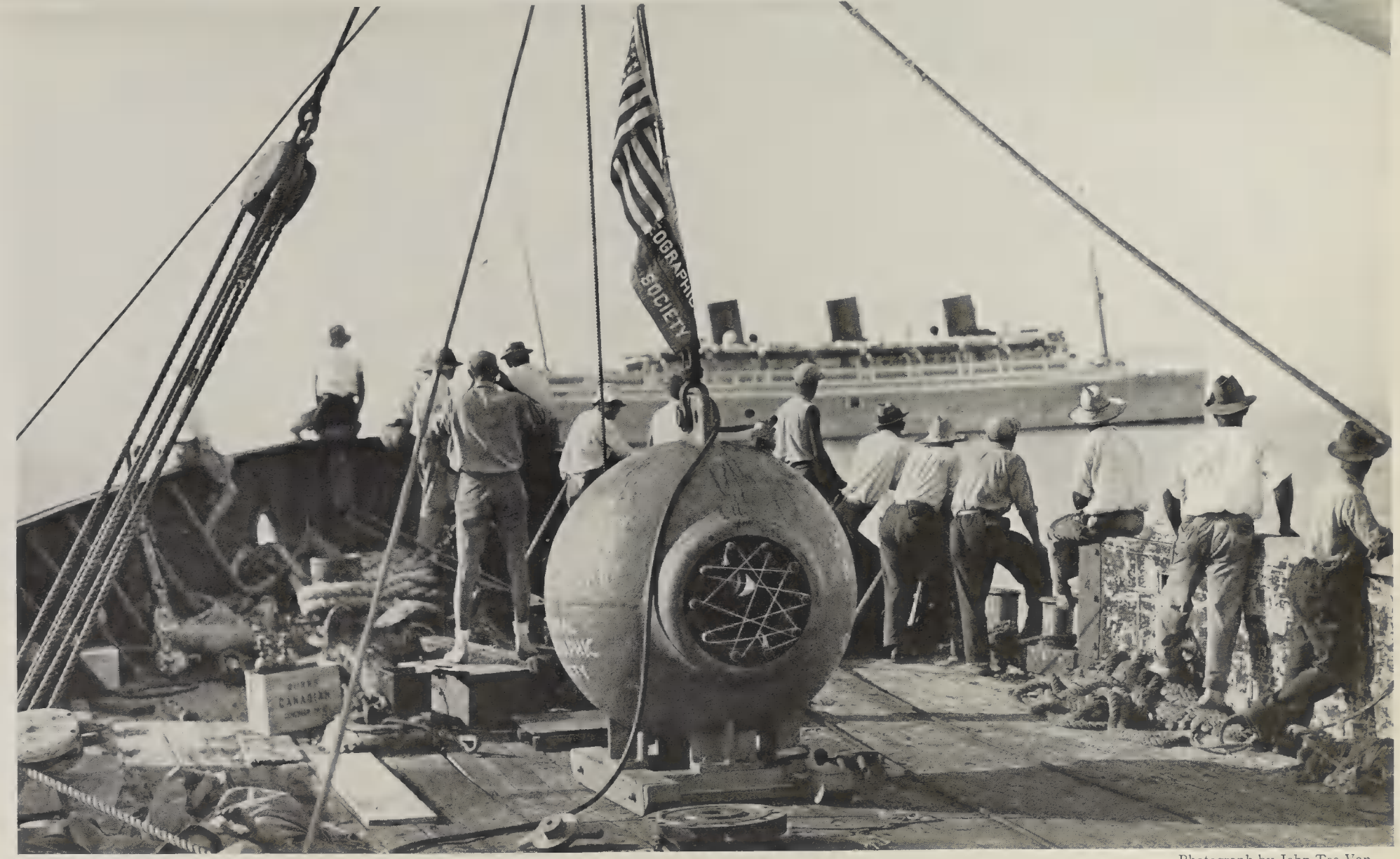
* See "Afield with the Spiders," by Henry E. Ewing, in the NATIONAL GEOGRAPHIC MAGAZINE for August, 1933.



Photograph by David Knudsen

THE MOTHER SHIP "READY" WAS ONCE A BRITISH MAN-OF-WAR

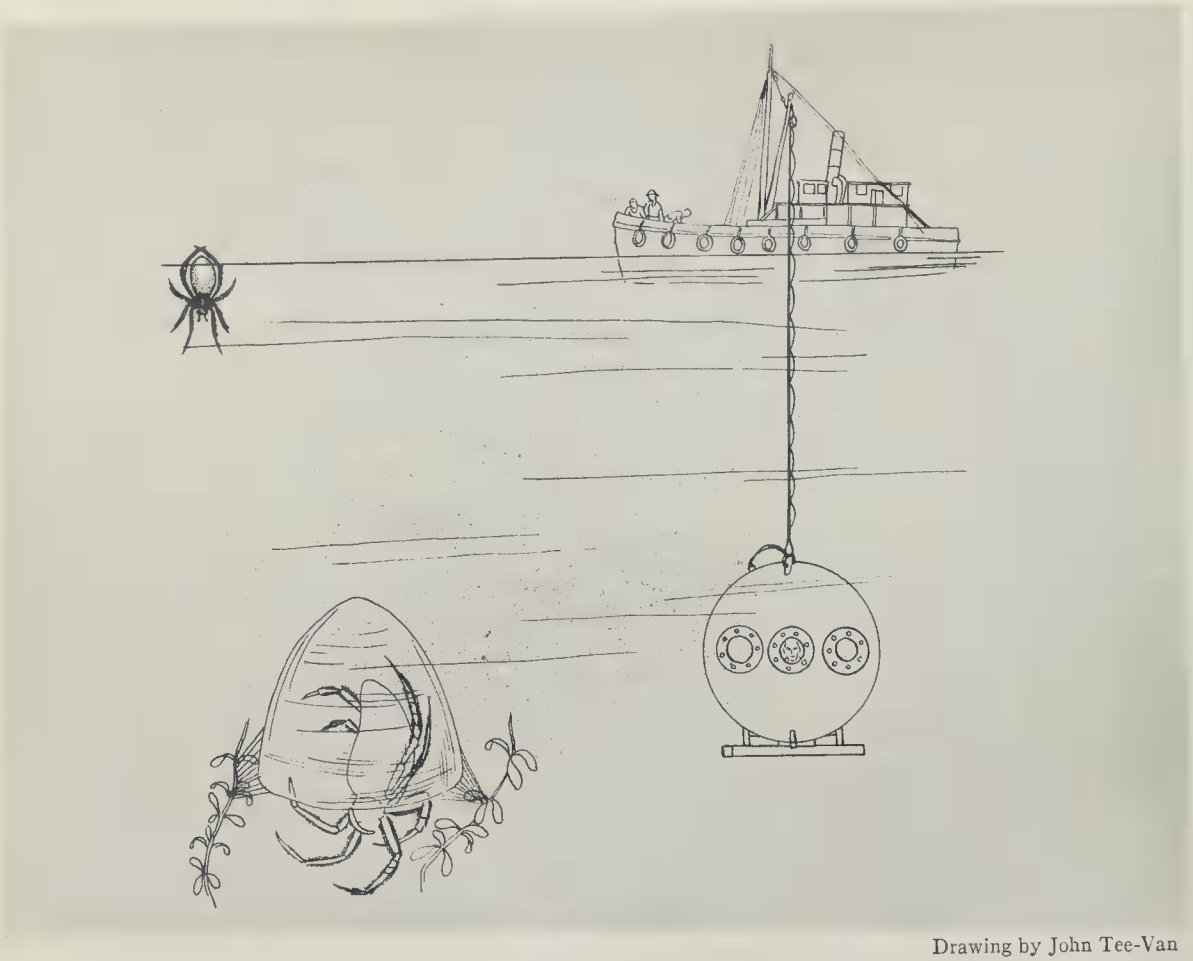
Following the deep-sea descent of August 11, when 2,510 feet was reached (note the chalked figures on the bow), a contour dive was made a mile off Nonsuch Island in 100



Photograph by John Tee-Van

THE "MONARCH OF BERMUDA" SALUTES A NEW WORLD'S RECORD

Returning to St. George after the 3,028-foot dive on August 15, the *Ready* passed the giant Furness liner outward bound for New York. The hoarse siren of the mighty passenger ship joined the din of harbor craft celebrating the expedition's achievement.



Drawing by John Tee-Van

NATURE PROVIDED THE WORLD'S EARLIEST "BATHYSPHERE"

Millions of years before man-made undersea devices were thought of, the water spider filled a sac with air and lived, ate, courted, and sheltered eggs in its under-water home. At the surface the artist shows one of these tiny creatures (not drawn to scale) capturing a bubble, which will be carried down and added to the store of air beneath the silken sheet fastened to aquatic plants.

balanced on a slender column of outpouring oxygen, and adjustable to exactly the right height and the fraction of a liter.

Even the earphones were replaced. The Bell Telephone Laboratories said that if I would let them have my old ones for their museum they would furnish sets of the latest models. Only a noncommercial naturalist about to undertake some new adventure or phase of exploration can ever realize the friendliness of hosts of people, and supposedly cold business corporations, who, perceiving an opportunity of adding to the factors of safety, go to all lengths of trouble and expense.

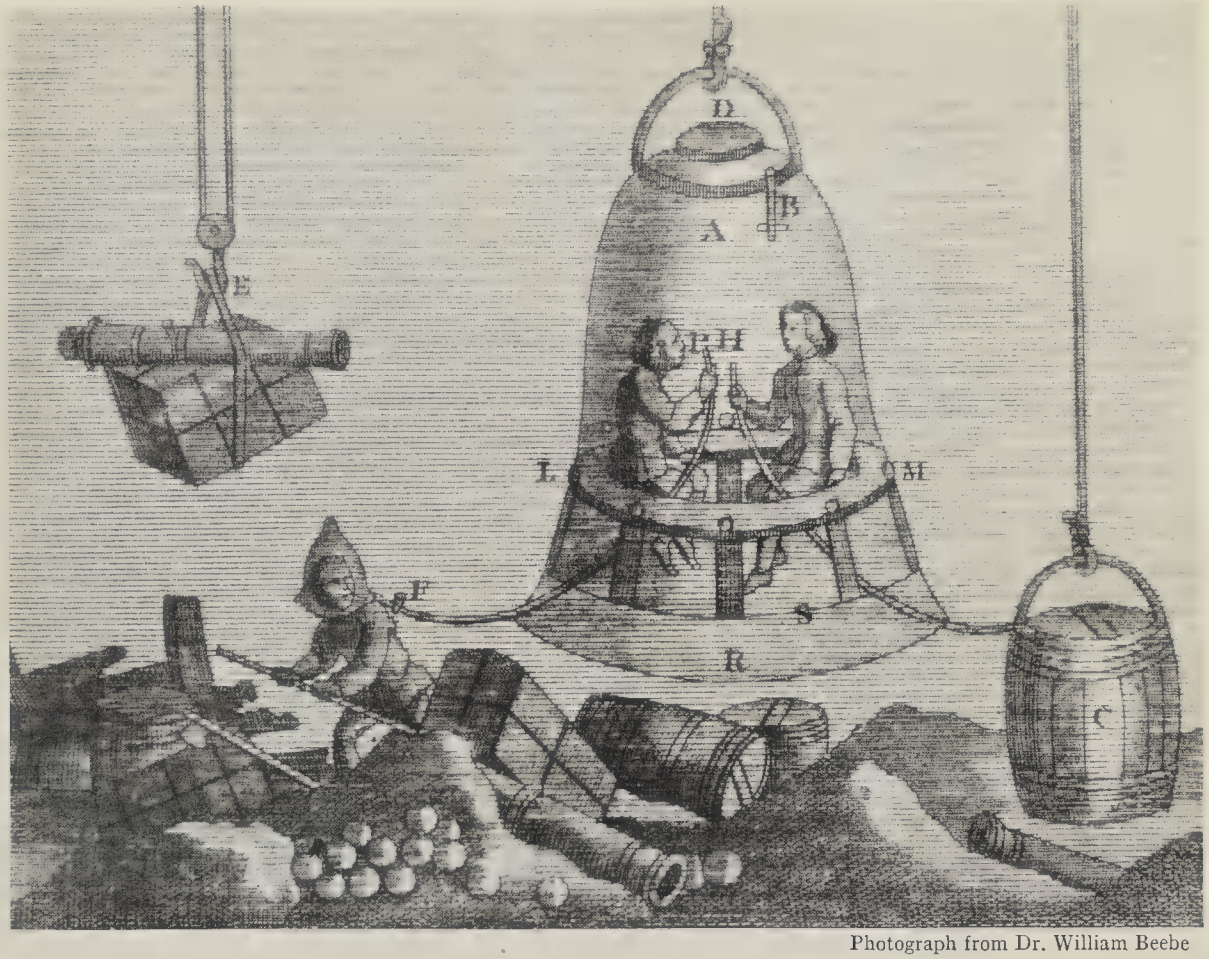
Finally the ten thousand and one details of an expedition such as this were initiated or completed and we were ready to depart for Bermuda. I cabled to Panama, inviting Otis Barton to join me if he wished, and he accepted, expressing a desire to concentrate on photography.

Together with Capt. H. J. Butler, Mr. Barton first developed the idea of a deep-sea sphere and financed the initial cost. In the autumn of 1930 Mr. Barton presented the Bathysphere to the New York Zoölogical Society, and it is now playing an important part in the study of Bermuda shore and deep-sea fish, researches upon which my staff and I have been engaged for the last six years.

BACK TO THE MOTHER SHIP "READY"

The Bathysphere arrived in Bermuda on July 5, and I visited her while she was deep down in the lowest hold of the *Monarch of Bermuda,* half hidden by cargo. Later in the same day she was hoisted into the blazing sunlight and lowered gently onto her old mother ship, the *Ready.*

Early on the first clear morning I took my associate, John Tee-Van, and my two assistants, Bass and Ramsey, down to the farthest end of St. Georges Harbor, where, in the midst of a welter of ancient ships,



Photograph from Dr. William Beebe

THIS EARLY DIVING BELL ACTUALLY WORKED

Fresh air was sent from the surface by alternating barrels, each of which was connected with the device by a leather hose. A single diver could work out on the open sea bottom by wearing a skin helmet, similarly tethered. Halley, the 18th-century physicist and astronomer, used such an arrangement in 9 to 10 fathoms of water for periods of an hour and a half.

we found the *Ready*. Near by lies a Peruvian gunboat, once bought by some Americans for a round-the-world cruise, which died a natural death in these waters.

Here, too, is the tug *Gladisfen,* newly painted, which for five years has faithfully drawn deep-sea nets—1,500 of them—through the waters of our eight-mile circle off Nonsuch Island. Our old friend, the *Tairun,* was another familiar sight, a three-masted schooner slowly rusting away on an even keel, to whose side the *Ready* was lashed (see map, page 670).

Our poor old Bathysphere appeared rather like some ancient Galápagos tortoise, or the shell of a sea turtle, scarred and dull, barnacled and stained. Her dark-blue color was sadly marred and scratched by her long journey, and her great eyes were closed with wooden lids.

With an impromptu block and tackle we got off the heavy door and took out all the new gear. I pried off the thick wooden eye plugs, and the new quartz lenses gleamed with the sheer transparency of mighty Koh-i-noor diamonds. New steel frames, much stronger than those which had been used before, held the three-inch-thick masses of quartz as firmly as if they had been part of the very steel.

An entire month was consumed in assembling, refitting, and testing all the intricate machinery, from the seven-ton winch, which was as nearly perfect as when I first used it on the *Arcturus,* almost ten years ago, to the delicate Friez temperature and humidity recorder.

Most of the instruments in the Bathysphere were intended to increase ease and clarity of vision through the quartz windows, but I was extremely anxious to utilize the facilities of these deep-sea dives in every possible direction, from the point of view of physics as well as that of zoölogy. Two difficulties presented themselves: first, the relatively small space left to us after the

Photograph by John Tee-Van

A FEW MORE TURNS, AND THE BOLT WAS RIPPED FROM HIS HANDS

During a test dive in 1932 one of the quartz windows leaked, and an implosion filled the Bathysphere with water at terrific pressure. The sphere was hoisted so rapidly that the imprisoned water could not escape. As the wing bolt (above) was unscrewed, air and water whistled through the cracks with a strange, high, singing sound. What happened a moment later is shown in the illustration on the opposite page.

disposition of our instruments and ourselves, and, second, the comparatively short time we should be able to remain at the greatest depths.

SPECTROGRAPH TOO LARGE FOR THE DOOR

Dr. George L. Clarke found that the only satisfactory spectrograph available was too large to go in through the 14-inch door. Concerning the recording of cosmic rays, Dr. R. A. Millikan wrote: "The rate of discharge is so exceedingly slow at great depths that we shall not be able to get any readings at all in the time during which you can stay down."

Throughout this month we shuttled back and forth among our three focal points—living quarters at the Bermuda Biological Station; the complete laboratory of the New York Zoölogical Society at New Nonsuch, the home of our library, instruments, and collections, where all of our preparations and researches are carried on; and finally our fleet—the *Skink, Gladisfen,* and *Ready,* 15 minutes away in St. Georges Harbor, the direct link between ourselves and our oceanographic investigations.

On the sixth of August, when we were ready to put to sea, our grand captain, Jimmie Sylvester, announced that he wanted a rehearsal for the whole crew, while we were still tied up to the ancient three-master close to shore. We all forgathered, set the instruments to work, put every man at his station; and Mr. Barton and I climbed into the Bathysphere.

The heavy door was lifted and swung home with its old familiar clang. There followed the ear-splitting crash of hammer on wrench as one mighty nut after another was twisted home (see page 673). Soon after, a warning came through the telephone and we were lifted and swung back and forth over the deck. It has always struck me as rather amusing that as a preliminary to descent we must always rise about 20 feet toward the stratosphere!

Within a minute or two I was surprised

Photograph from Dr. William Beebe

EXPLOSION FOLLOWED IMPLOSION

After clearing the deck in front of the sphere, Dr. Beebe jumped to one side of the hissing wing bolt and gave it a final twist. Like a shell from a cannon, it shot across the deck and crashed into the steel winch 30 feet away. The trajectory was almost flat, and the whole ship was drenched with the spray and water which, suddenly released, roared from the interior of the Bathysphere. Any one who had been in the way would have been decapitated (see text below).

to see the humidity dial shoot across the record card, and I realized that our new apparatus was working with swiftness and accuracy. The chief reason for this abrupt approach to saturation point was Mr. Barton, who was sitting, soaked to his skin, on his side of the Bathysphere. My canoe had tipped over alongside, and he had valiantly dived overboard to right her and salvage the paddles.

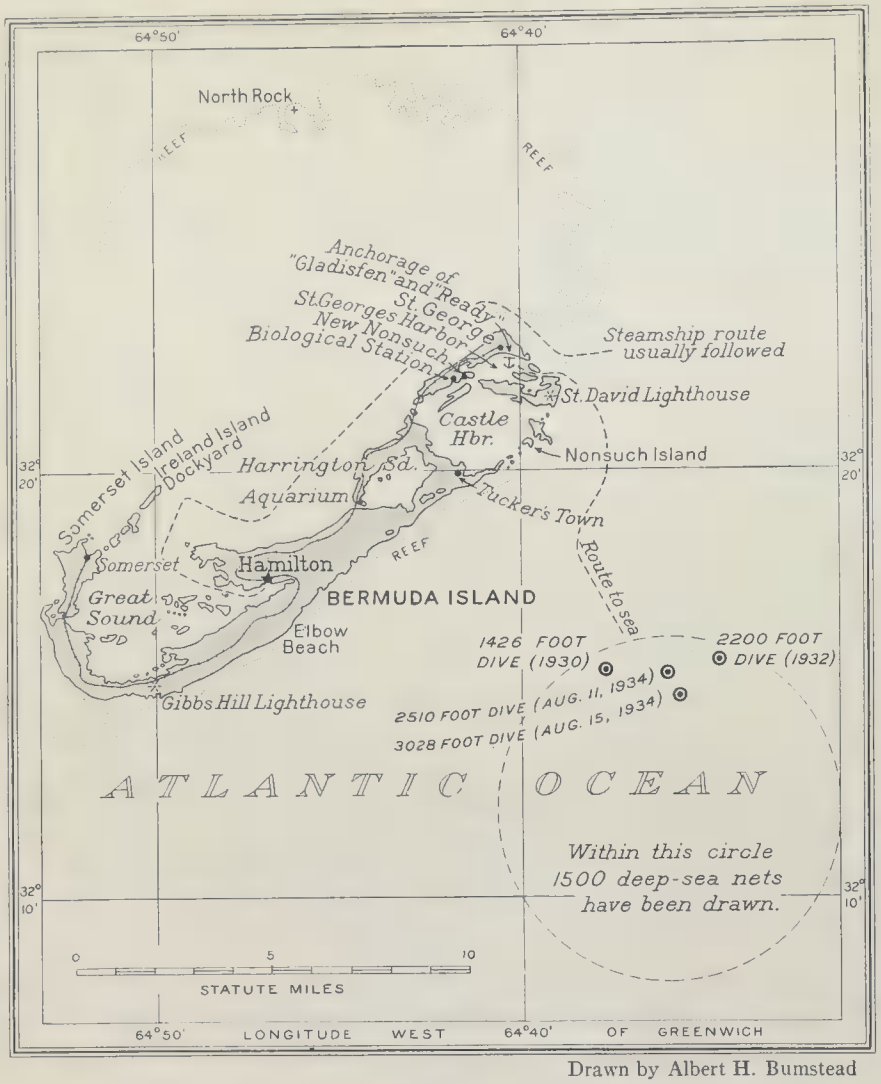
FOUR FEET DOWN, AND A LEAK

We swung up and overside and then down into the water through a smother of foam and bubbles, but without the slightest jar. Instantly I forgot the dials and records, for through the window appeared a dense mist of small fry, excitedly swimming about us. Although there must have been something more than a hundred-degree angle between the sun and my eyes, yet every individual fish made an occasional heliograph of itself, and as it turned sideways shot down a dazzling flash from its silvery sides.

My ichthyo-physics were suddenly interrupted by a feeling of chill about my feet and ankles, and, reaching down, I found about eight inches of water. Barton leaned to one side and I saw a perfect cataract of water pouring in from both sides of the door. His saturated condition had made him oblivious of the new source of wetness. From our depth of not more than four feet I called for an immediate ascent.

This shallow test dive had seemed so brief and safe that it had very reasonably been thought that four of the great nuts would hold the door in place instead of the ten used on deep dives. The result was a joking matter, but nevertheless showed how necessary it was never for an instant to relax precautions.

This incident brought vividly to mind the most serious accident we have ever experienced in deep-sea diving. Two years ago we attempted to replace the steel plate in the port socket with a window of fused



Drawn by Albert H. Bumstead

THE DIVING AREA LIES SOUTHEAST OF BERMUDA

Most of Dr. Beebe's deep-sea researches have been conducted within the dotted circle (lower right). The reefs near North Rock (upper left) afford rich fields for a diver with a helmet to study shallow-water fishes and coral formations (see text, page 692).

quartz, and on our next day at sea we lowered the empty Bathysphere to a great depth in a test dive.

After letting her hang quietly for a few minutes, we pulled her up for inspection. Even when she was only half out of water it was apparent to the experienced eye that something was very wrong. When she swung clear, I saw a needle of water shooting across the face of the new window.

Weighing much more than she should, she was lifted wabbling over the side and lowered to the deck. I looked through one of the old windows and could see that she was almost full of water. There were curious ripples on the surface of the enclosed water.

I began to unscrew the giant wing bolt in the center of the door. After the first few turns, a strange, high singing came forth; then a fine mist, steamlike in consistency, shot out. Another and another warned me of what I should have sensed when I looked through the window—that the contents of the Bathysphere were under terrific pressure.

I cleared the deck in front of the door of every one, staff and crew. One motion-picture camera was placed on the upper deck and a second close to, but well to one side of, the Bathysphere. Carefully, little by little, two of us turned the brass handles, soaked with the spray; and I listened as the high, musical tone of impatient, confined elements gradually descended the scale. Realizing what might happen, we leaned back as far as possible from the direct line of fire.

Suddenly, without the slightest warning, the bolt was torn from our hands, and the mass of heavy metal shot across the deck like a shell from a gun. The trajectory was almost straight, and the brass bolt hurtled into the steel winch 30 feet away, shearing out a half-inch notch!

This was followed by a solid cylinder of water, which slackened after a while to a cataract, pouring out of the hole in the door, air mingling with the water, looking like hot steam instead of compressed air shooting through ice-cold water. If I had been in the way I should certainly have been decapitated (see illustrations, pages 668, 669).

All my life I had read of the terrific pressures at great depths and had seen bottles and tin cans come up crushed,

but never until then had I had first-hand visual proof. We tested the water temperature and found it 56 degrees Fahrenheit, which showed that the primary break had occurred about 2,000 feet down. When I bailed out the rest of the water we pushed out the new quartz window and found it to be in perfect condition. The whole trouble had been in the packing.

Thus I have seen the results of an implosion in the Bathysphere 2,000 feet down, where in the icy blackness we should have been crushed into shapeless tissues by nothing more substantial than air and water.

Prophecy for August 7 was squalls and uncertain winds. For no special reason I selected it as a possible first day at sea, and the night before ordered steam up in the tug and the boilers of the barge. At 5 o'clock dawn a glance at the slender, motionless cedar tips beyond my veranda justified my gamble. After a hasty breakfast we chugged down harbor in the *Skink* in pursuit of the ancient *Ready,* with her precious globe of ultramarine just showing above the bulwarks and shining in the rain-washed air.

Photograph courtesy of the Bibliothèque de Bourgogne, Brussels, and of the New York Public Library

A 13TH-CENTURY FRENCH MANUSCRIPT PRESENTS ALEXANDER THE GREAT AS A DIVER

The famous ruler who sighed for new worlds to conquer was, legend says, the first man to go deep into the ocean merely to look at fish. Several versions of the story declare that he saw a monster which took three days to swim past his glass cage!

Farther ahead the great towing cable alternately became taut and slacked off, now dipping below the surface, now snapping up into steellike rigidity, flicking a vertical wave of foam into the air. The tug threaded its way through the narrow hole-in-the-wall, and we lifted quietly on the gentle, breathing swell of the open ocean

Gentle though the swell was, and flat calm as the sea appeared when we transferred to the *Ready,* the rise and fall were as inexorable as the movement of some mighty engine, and we had to throw our gear with precision and time our jumps accurately to avoid serious trouble.

A MILE OF WATER UNDER THE KEEL

Two hours later Bermuda was only a string of pale beads seen through a mist of rain along the horizon, and careful sights showed that we were well within our eight-mile circle. Here I knew I had a mile or more of water under the keel, and we slowed down.

The Bathysphere had been stripped for a test dive, the two instruments left inside being a temperature and humidity recorder and Mr. Barton's automatic camera. The

Photograph by John Tee-Van

SKILLED HANDS TIE ON THE COMMUNICATIONS CABLE

At intervals of 100 feet the rubber-sheathed strand carrying the telephone and electric power lines is fastened to the main supporting wire. Formerly iron clamps were employed, but these were discarded in favor of rope, which could be cut in case a quick ascent became necessary.

Photograph by David Knudsen

INSPECTION OF TELEPHONES PRECEDES EACH DESCENT

Hundreds of messages pass up and down the slender wires that constitute the only communication with the outside world. Five seconds is the longest period of silence permitted between calls; for those on each end of the line must know constantly that all is well.

"HELLO! IS THIS DAVY JONES'S LOCKER?"

Miss Gloria Hollister and John Tee-Van, Dr. Beebe's associates, indulged in a bit of persiflage as the Bathysphere dangled at nearly half a mile below the surface of the sea on August 11, 1934. They were alert, however, for any sound that might indicate trouble below.

Photographs by David Knudsen

THE ANVIL CHORUS IS EAR-SPLITTING TO THOSE INSIDE

Every one of the ten heavy nuts which seal the 400-pound door of the Bathysphere must be tightened with wrenches struck by heavy hammers. To the explorers within, the din is terrific. The central wing bolt has not yet been screwed into the door.

Photograph by Robert Hartley

HEAD FIRST IN FOR A DIVE!

Dr. Beebe goes aboard in true diver's fashion. When he has settled himself on the cold, hard bottom of the sphere, Mr. Barton crawls in, and the door is bolted tight. Wriggling over the sharp steel bolts is the most painful experience of the whole adventure.

only difference between this dive and a regular one is that we were not inside, and of course no messages came and went over the telephone wires.

When everything was set, each person at his post, and the *Ready* momentarily balanced on an even keel, Mr. Tee-Van gave a signal, Captain Sylvester threw a thread of steam into the mighty winch, and, delicately as a fine watch, the huge drum began to turn, the cable tightened, and the Bathysphere rose slowly, straight upward to the nose of the boom.

It swung there for a moment and then a second winch came into play, and boom and sphere moved outward. When far enough from the side of the *Ready,* the cable paid out rapidly and, before the oncoming swell could rise and exert its effect, the Bathysphere was safe, several feet under water.

Then the boom winch swung its burden in toward the *Ready* until the cable was within reach of a cluster of men at the bulwarks. These were in charge of the telephone cable, of which more than a half mile lay in many oblong coils along one side of the deck. A file of men lifted this heavy, solid-rubber hose and passed it carefully out and overboard as the Bathysphere descended. Every hundred feet it was fastened by a master carpenter with a cunning knot and sling of rope to the steel cable (672).

DUTIES OF THOSE ON DECK

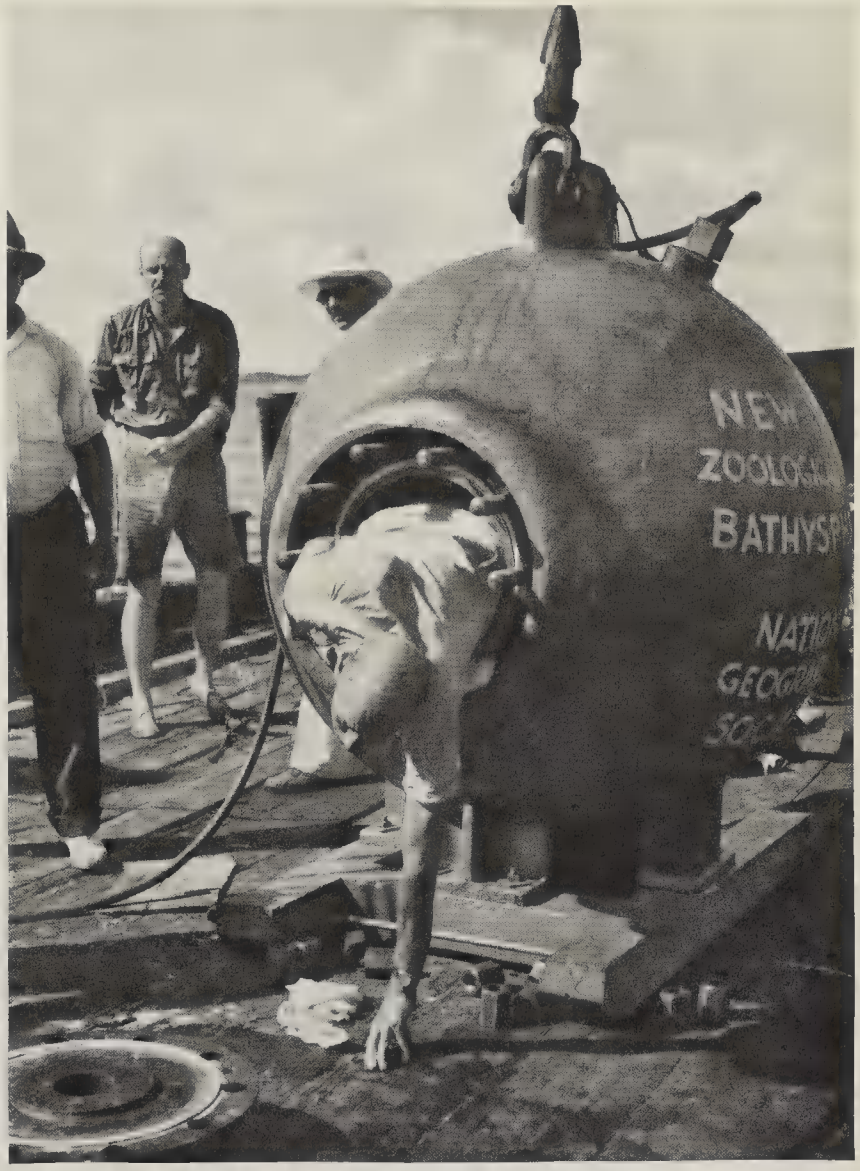
Within earshot of Miss Crane, the depth-recorder, and in full view of the whole operation, Miss Hollister sits with earphones and mouthpiece, recording everything I see from within the Bathysphere, relaying my orders to Tee-Van, and sending down whatever information concerning depth, time, and weather I may desire (see illustration, page 673). Perkins Bass and William Ramsey, of my staff, are in full charge of the generators. They are also responsible for the cable marking. Mr. Tee-Van has an extra pair of earphones, in case of emergency, and an abundance of loose, small telephone wire, giving him sufficient play to enable him to walk about at will.

The empty Bathysphere swung overside about 11:30 a. m. Less than an hour and a half later the cable record indicated that the sphere was dangling at a depth of 3,020

feet. Mr. Barton, by an electrical device controlled through the cable, exposed 400 feet of film, and, after a total of three hours of blazing sun, alternating with driving rain and chilling breezes, the Bathysphere was again on deck.

I peered in through the cold, dripping windows, and the test was perfect. Not a drop had leaked through windows, stuffing box, or door. The card of the atmosphere recorder told the story of the air temperature, beginning with 91 degrees Fahrenheit at the surface and touching 51 degrees in the lowermost depths.

Later in the week I threw my dice against unsettled weather, and again I won. At 9:30 a. m. on Saturday, August 11, I looked about from the deck of the *Ready* and saw the long, low swell of a calm day. We were well within the magic circle, 6½ miles southeast of Nonsuch Island, and at once slowed down, headed upswell, and prepared to dive



Photograph by David Knudsen

HEAD FIRST OUT COMING UP!

Second in discomfort to entering the Bathysphere is the tumble over the rough-edged doorway upon emergence. All dignity is tossed to the winds until the divers have regained their balance. Mr. Barton watches at the left while the leader gingerly crawls forth.

More than three and a half years ago I wrote for the National Geographic Magazine (see footnote, page 661) an account of a dive to a depth of 1,426 feet. Here I was again on the selfsame ancient barge with the identical Bathysphere and within a mile and a half of the very spot where I had made the former descent. An equal distance to the east marked the spot of a more recent dive to 2,200 feet.

All the sights which came to my eyes are as vivid now as then; yet, on the eve of this new venture, I felt as if the former dives had been nothing but amazing dreams; that my ignorance of the world of life beneath our feet was almost complete.

However, my chief concern at the moment was to wriggle over the unpleasant bolts with as little damage as possible, coil myself up in the window sector of the Bathysphere, clamp on my telephone outfit, and arrange all my instruments and small but necessary possessions.

Adequate presentation of what I saw on this dive is one of the most difficult things I ever attempted. It corresponds precisely to asking a foreigner who has passed a few hours in New York City, "What do you think of America?" Only the five of us who have gone down even to 1,000 feet in the Bathysphere know how hard it is to find words to translate this world.

At 9:41 we splashed beneath the surface, and, often as I have experienced it, the sudden shift from a golden yellow world to a green one was unexpected. After the foam and bubbles had passed from the glass, we were bathed in green; our faces, the tanks, the trays, even the blackened walls, were tinged. Yet, seen from the deck, we apparently descended into sheer, deep ultramarine.

OCEAN SURFACE BECOMES A CEILING

We were dropped several fathoms, and dangled there awhile until all the apparatus on deck was readapted to the vertical cable close to the ship's side. I made the most of my last glimpse of the upper world. By peering up, I could see the watery ceiling crinkling and slowly lifting and settling, while here and there, pinned to this ceiling, were tufts of sargassum weed. I could see small dots moving just below the weed, and for the first time I tried, and successfully, to focus low-power binoculars through the water. I had no trouble in recognizing a small ocean turbot and a flying fish trailing its half-spread wings as it swam.

A question came over the phone, an answer went, and down we slipped through the water. As I have said, the first plunge erases to the eye all the comforting warm rays of the spectrum. The red and the orange are as if they had never been, and soon the yellow is swallowed up in the green. Although the cheerful rays are only one-sixth of the visible spectrum, yet, when they are winnowed out at a hundred feet or more, all the rest belongs to chill and night and death, helping us to understand why it is not red blood and scarlet flames that paint the real horror of modern war, but the terrible grayness of gas, the ghastly blue of Very lights.

The green faded imperceptibly as we went down, and at 200 feet it was impossible to say whether the water was greenish-blue or bluish-green. I made my eyes focus in midwater and saw small creatures clearly, copepods and others of the innumerable swarms which haunt the upper layers.

At 320 feet a lovely colony of siphonophores drifted past, appearing like spun glass. Others, which I saw at far greater and blacker depths, were illumined; but whether by their own or by reflected light I cannot say. These are colonial creatures, like submerged Portuguese men-o'-war, and, similar to those beautiful beings, are composed of a colony of individuals which perform separate functions, such as flotation, swimming, stinging, feeding, and breeding, all joined by the common bond of a food canal.

When scores of Bathyspheres are in use we shall know much more about the vertical distribution of fish than we do now. For example, my next visitors were good-sized yellow-tails and two blue-banded jacks, which examined me closely at 400 and 490 feet, respectively. There were so-called surface fish happy at 80 fathoms (480 feet).

At 600 feet the color appeared to be a dark, luminous blue, and this contradiction of terms shows the difficulty of description. As in former dives, it seemed bright, but was so lacking in actual power that it was useless for reading and writing.

There are certain nodes of emotion in a descent such as this, the first of which is the initial flash of animal life. This came at 670 feet, and it seemed to close a door upon the upper world. Green, the world-wide color of plants, had long since disappeared from our new cosmos, just as the last plants of the sea themselves had been left behind, far overhead.

SMALL BEINGS SWARM AT 800 FEET

At 700 feet the light beam from our bulb was still rather dim; the sun had not given up and was doing his best to assert his power. At 800 feet we passed through a swarm of small beings, copepods, *Sagitta,* or Arrow Worms (see Plate XIV), and every now and then a worm which was not a worm but a fish, one of the innumerable Round-mouths, or *Cyclothones.*

At 1,000 feet we took stock of our surroundings. The stuffing box and the door were dry, the noise of the blower did not interfere with the telephone conversation; the humidity was so well taken care of that I did not need a handkerchief over nose and mouth when talking close to the glass. The steel was becoming very cold. I tried to name the water—blackish-blue, dark-gray blue.

It is strange that, as the blue goes, it is not replaced by violet, the end of the visible spectrum. That has apparently already been absorbed. The last hint of blue tapers into a nameless gray, and this finally into black; but, from the present level down, the eye falters and the mind refuses any articulate color distinction. The sun is defeated, and color is banished forever,

© National Geographic Society Painting by Else Bostelmann. Fish One Twenty-fourth Natural Size

GIANTS OF THE DEEP GREET THE BATHYSPHERE

Which must have seemed the stranger to the other—the odd, steel sphere with its huge eyes and piercing searchlight, or the six-foot monster gleaming like an ocean liner and trailing its own "traffic lights?" Sighted at 2,000 feet below sea level, this big creature was named *Bathysphaera intacta*, or the Untouchable Bathysphere Fish. It has not yet been caught in the nets.

© National Geographic Society

Painting by Else Bostelmann. One-half Natural Size

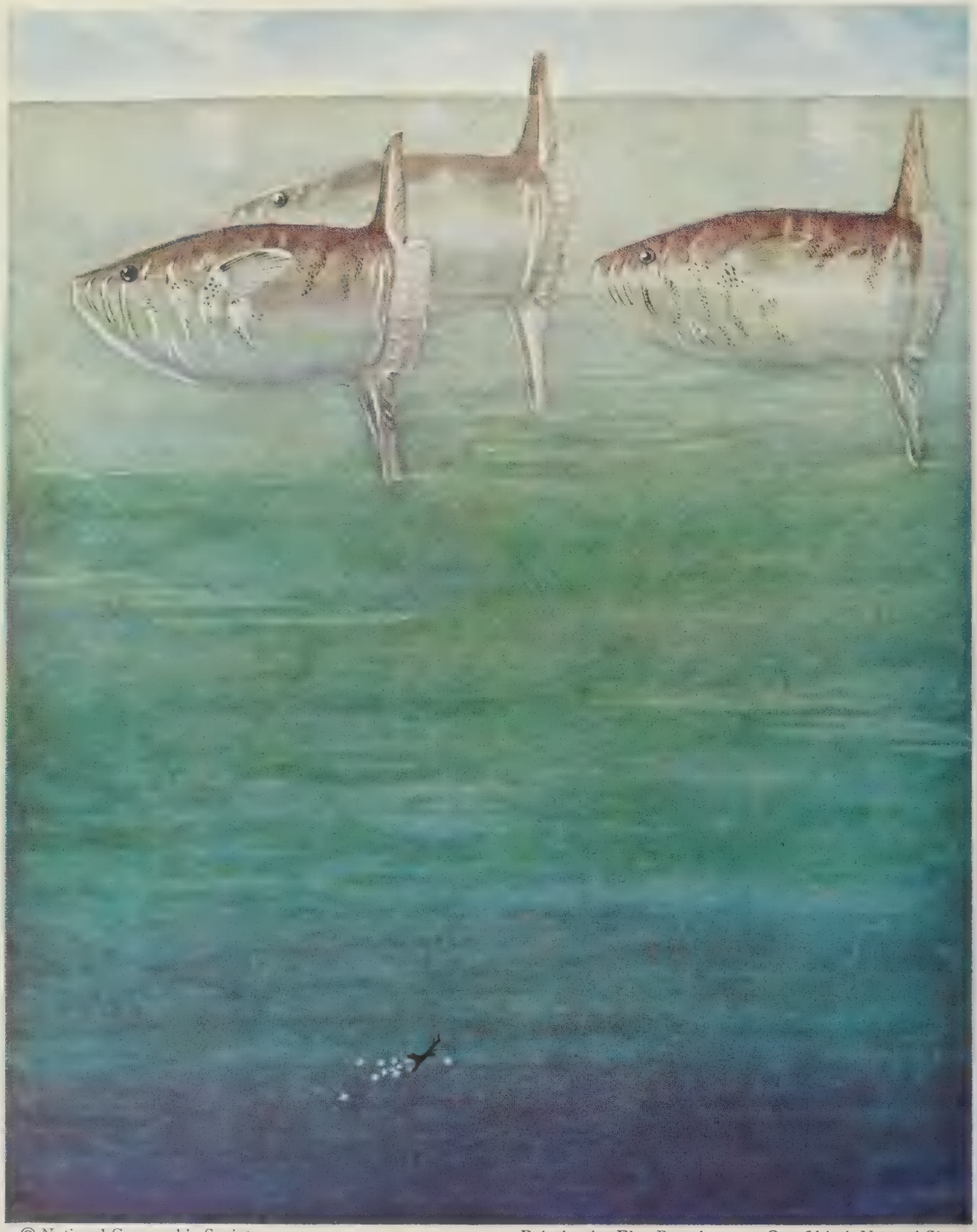
ABYSSAL RAINBOW "GARS" EXECUTE "COMPANY FRONT"

At 2,500 feet, at 11:17 a. m. on August 11, 1934, the electric searchlight was switched on suddenly, disclosing these brightly-colored fish balanced on their tails in military formation. They swam slowly and stiffly out of sight, leaving in mind only what the artist has drawn. Doctor Beebe is not positive that his tentative designation of them as gars is correct, but they at least have the most remarkable coloration ever recorded in deep-sea fish.

© National Geographic Society Painting by Helen D. Tee-Van. One-third Natural Size

TWO SCHOOLS FORM A WARP AND WOOF OF FISH

At the sight of the gleaming Bathysphere, as it slowly descended in shallow water, hundreds of Smooth Sardines (*Sardinella anchovia*) dashed rapidly downward, while scattered Blue Chromis (*Demoisellea cyaneus*) threaded a way more quietly in and out among their frightened neighbors. Neither has appeared close to the shores of Bermuda and, until sighted from the Bathysphere, they had not been included in the island's fauna.



© National Geographic Society Painting by Else Bostelmann. One-fiftieth Natural Size

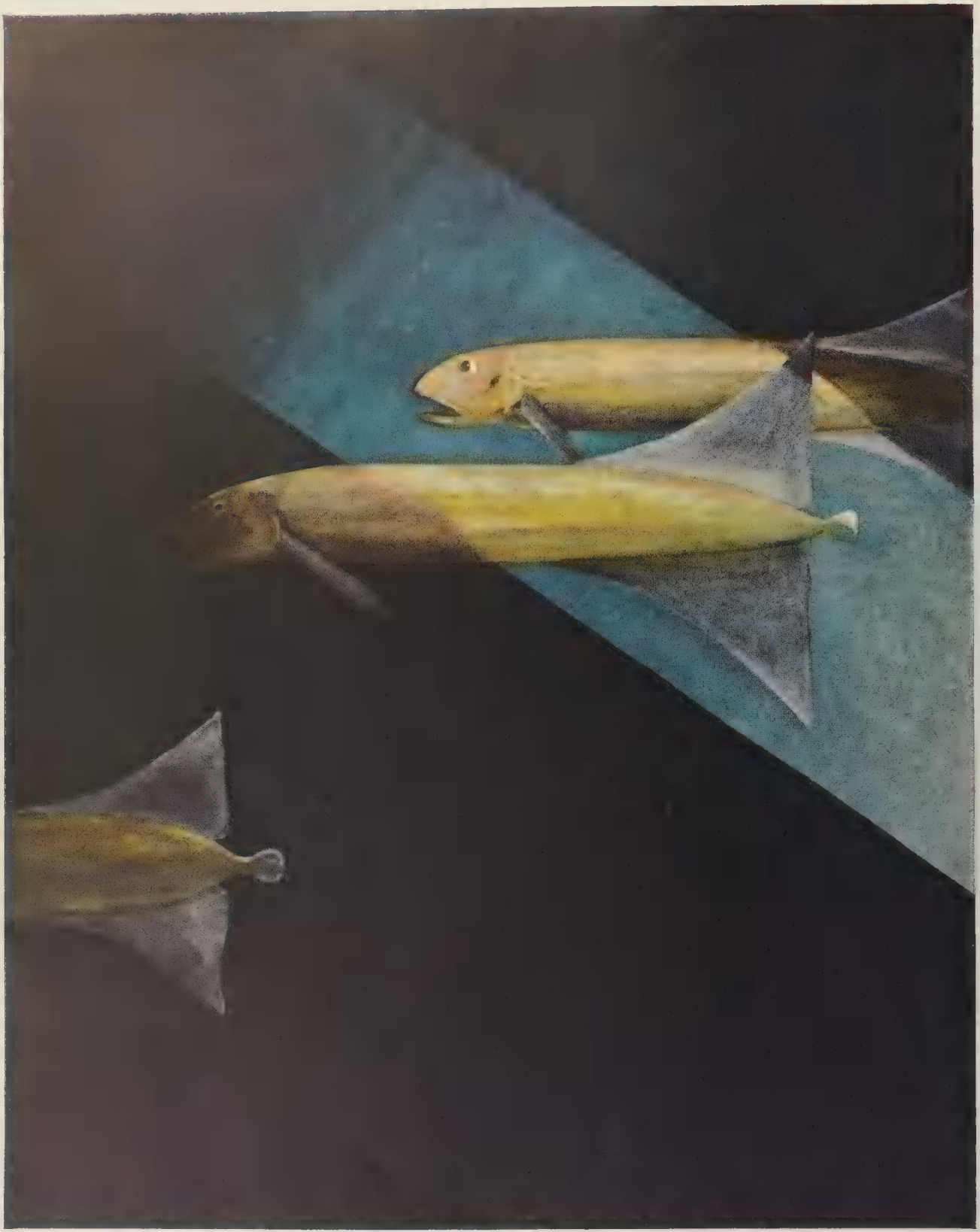
OCEAN SUNFISH SPEND THEIR YOUTH IN THE DEPTHS

These slow-moving, thick-set fish (*Ranzania truncata*) are fully eight feet long. Although they are fairly common in the Gulf Stream, there is no record of any being caught near Bermuda. As many as 30 newly hatched young, however, each no larger than the head of a pin, have been taken in nets off that island at a depth of a quarter of a mile, where they are the prey of the Viperfish and other predatory species (lower center).

© National Geographic Society Painting by Else Bostelmann. Sixteen Times Natural Size

A FISH-EYE VIEW OF A MICROSCOPIC TRAGEDY

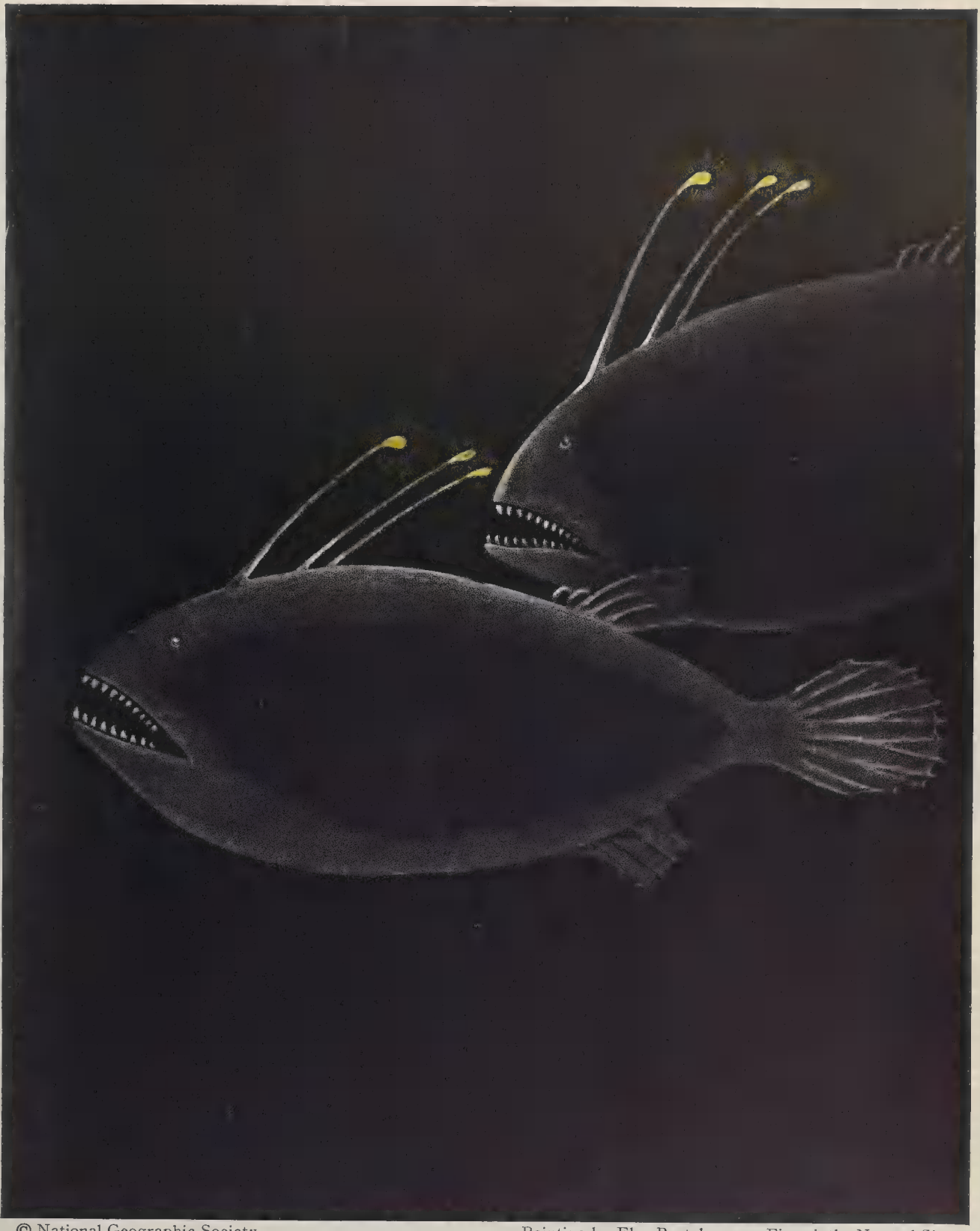
This drawing is a greatly enlarged close-up of the head of the Saber-toothed Viperfish (*Chauliodus sloanei*; see Plate X). This creature is pictured near the bottom of the opposite plate in the act of attacking the tiny young of the Ocean Sunfish. The latter are mostly eyes and sharp spines, showing no promise of the fleshy bulk that they attain in their adult stage, but the fangs and appetite of the ogre of the depths make light of their protective armor.



© National Geographic Society Painting by Else Bostelmann. One-sixth Natural Size

RARE CORPSE-HUED FISH GLIDE BY LIKE WRAITHS

At a depth of 1,500 feet and again at 2,500 feet this ghostly-looking creature, fully two feet long, was observed as it swam across the swath of light from the Bathysphere. Until a specimen can be captured in the nets, it has been decided to put it in the family Cetomimidae. Nonscientific folk may call it the Pallid Sailfin. Especially conspicuous were its enormous vertical fins and very small tail fin. Its eye is small, and the mouth appears to be toothless.



© National Geographic Society Painting by Else Bostelmann. Five-sixths Natural Size

THIS FELLOW CARRIES HIS OWN "LIGHTHOUSES"

The Three-starred Anglerfish, new to man, is six inches long. It was clearly outlined for two seconds at a depth of 2,470 feet. It showed a trio of tall, light-tipped masts, and revealed its relationship to the Black Anglers (*Cryptosparas*), although unlike any known species or genus. No paired fins were observed, although they must have been present. The light was pale yellow, and so strong that it was clearly reflected on the dark skin of the back.

© National Geographic Society Painting by Else Bostelmann. Ten Times Natural Size

HIGHLY COLORED, BUT THEY HAVE NO COLOR OF THEIR OWN!

Sapphirina, opalescent, deep-sea crustaceans, are not large, but they glow like an opal, and, like that stone, by reflected light, not pigment, A large proportion of the small, drifting life of the deep sea is composed of such creatures, members of the large order of Copepods. The latter vie with the insects of the upper world in abundance and variety, and they are important as food for hundreds of different varieties of fishes.

until a human at last penetrates and flashes a yellow electric ray into what has been jet black for two billion years.

I kept the light on for a while, and at 1,050 feet, through a school of little flying snails, there suddenly passed a "large dark body, more than 4 feet long" (so I telephoned it). I shut off the light, but looked into empty gray space without a trace of lumination. The fish had dissolved. When I had the light on again, 10 feet lower, a Pilotfish appeared, showing how easily his kind can adapt itself to a shift of more than 30 atmospheres, and from 15 pounds an inch pressure at the surface to 480 here.

EXCITING SIGHTS CROWD THICKLY

Lights now brightened and increased, and at 1,100 feet I saw more fish and other organisms than my pre-Bathysphere experience had led me to hope to see on the entire dive. Several chunky little Hatchetfish approached and passed through the light; then a silver-eyed larval fish two inches long; a jelly. A dim, very deeply built fish appeared and vanished; then a 4-inch larval eel swam obliquely upward; and so on. The ceaseless telephoning left me breathless and I was glad of a hundred feet of only blue-blackness and sparks.

At 1,200 feet an "explosion" occurred, not at the window but a few feet away, so baffling that I decided to watch intently for repetitions. The large fish came again, and a loose, open school of pteropods and small shrimps bobbed about.

Suddenly, in the distance, a strong glow shot forth (again the mysterious "explosion"), covering a space of perhaps eight inches. Not even the wildest guess would help with such an occurrence (see text, page 701). Then the law of compensation sent, close to the window, a clear-cut, three-inch Black Anglerfish with a pale, lemon-colored light on a slender tentacle. All else my eye missed; I can never give it a name.

A FISH NEW TO SCIENCE

At 1,500 feet I swung for two and a half minutes, and here occurred the second memorable moment in these dives—opportunity for the deliberate, accurate record of a fish wholly new to science, seen by one or both of us, the proof of whose existence, other than our word, must await the luck of capture in nets far more effective than those we now use in our oceanographic work.

First, a quartet of slender, elongate fish passed through the shaft of electric light. They were literally like arrows, about 20 inches long, whether eels or not I shall never know; then a jelly so close that it almost brushed the glass. Finally, without my seeing how it got there, a large fish swung suspended, half in, half out of the beam (see Plate VI). It was poised with only a slow waving of fins.

I saw it was something wholly unknown, and I did two things at once: I reached behind for Mr. Barton, to drag him away from his camera preparations to the window, to see and corroborate, and I disregarded Miss Hollister's insistent questions in my ears. I had to grunt or say something in reply to her, for I had already exceeded the five seconds which was our danger duration of silence throughout all the dives. But all this time I sat, absorbing the fish from head to tail, through the wordless, short-circuiting of sight, later to be materialized into spoken and written words, and finally into a painting dictated by what I had seen through the clear quartz.

The strange fish was at least two feet in length, wholly without lights or luminosity, with a small eye and good-sized mouth. Later, when it shifted a little backward, I saw a long, rather wide, but evidently filamentous pectoral fin. An unusual thing was the color, which, in the light, was an unpleasant pale olive drab, the hue of water-soaked flesh, an unhealthy buff. It was a color worthy of these black depths, like the sickly sprouts of plants in a cellar.

SEEKING THE FAMILY OF A GHOST

There is a small family of deep-sea fish known as *Cetomimidae,* and somewhere in or close to this the strange apparition belongs. Only three species are known, and only 24 individuals have been captured, 16 of which have been in our own deep nets drawn through these very waters. I have called the fish we saw the Pallid Sailfin, and am naming it *Bathyembryx istiophasma,* which is a Greek way of saying that it comes from deep in the abyss and swims with ghostly sails.

The Sailfin was alive, quiet, watching our strange machine, apparently oblivious that the hinder half of its body was bathed in a strange luminosity. Preëminently, however, it typified the justification of the money, time, trouble, and worry devoted

Photograph by John Tee-Van

THE ARTIST'S CORNER AT NEW NONSUCH

In this cheerful studio, whose tall windows overlook the ever-changing blues and greens of Castle Harbor, Mrs. Else Bostelmann prepared many of the color plates reproduced in this issue. The drawings are based on sketches made by Dr. Beebe and from notes of his observations telephoned to the surface during deep-sea dives.

to bringing the Bathysphere to its present efficiency.

At the possible risk of cumbering taxonomy with a *nomen nudum,* I have chosen to give definite names to a very few of these clearly seen fish,* the physical type of which must, for a time, be represented by a drawing made under my direction, with only the characters of which I am certain.

At 1,900 feet, to my wonder, there was still the faintest hint of dead gray light, 200 feet deeper than usual, attesting the almost complete calm of the surface and the extreme brilliancy of the day far overhead. At 2,000 feet the world was forever black. And this I count as the third great moment of descent, when the sun, source of all light and heat on the earth, has been left behind. It is only a psychological milepost, but it is a very real one. We had no realization of the outside pressure, but the blackness itself seemed to close in on us.

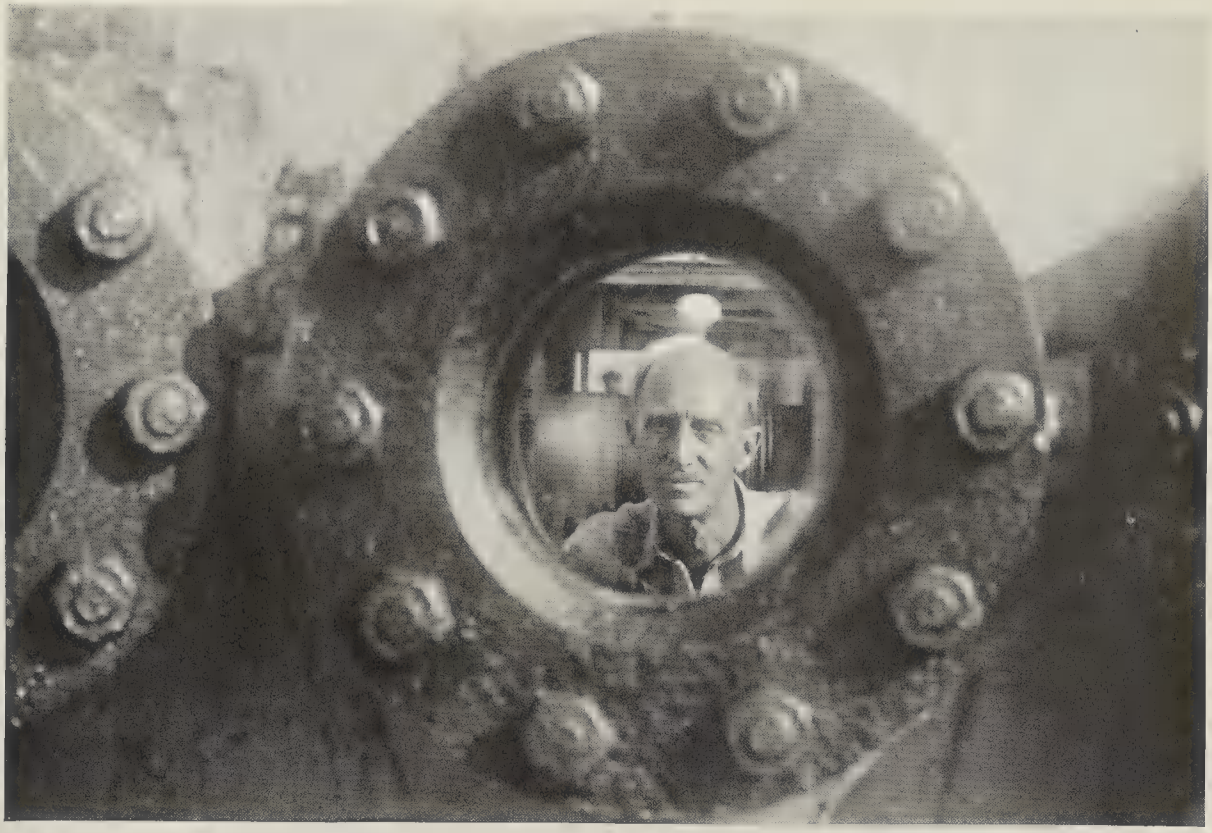
MYSTERY STIRS IN THE BLACKNESS

At 2,000 feet and again on the way up I saw at the very end of our beam some large form swimming. On earlier dives I had observed this and had hesitated even to mention it, for it savored too much of imagination backed by imperfect observation. But here it was again. The surface did not seem black, and what outline came momentarily to view was wholly problematic. But that it was some very large creature or creatures, of which we had glimpses five separate times on dives separated by years, we are certain.

At 2,300 feet some exclamation of mine was interrupted by a request from above to listen to the tug's whistles saluting our new record, and my response was, "Thanks ever so much, but take this: Two very large *leptocephali* have just passed through the light, close together, vibrating swiftly along. Note—why should larval eels go in pairs?"

With this the inhabitants of our dimly remembered upper world gave up their kindly efforts to honor us. On down we went, through a rich, light-speckled 2,400 feet, to rest at 2,500 feet for a long half hour.

* Preliminary descriptions have appeared in the *Bulletin of the New York Zoölogical Society,* Vol. XXXVII, No. 6.



"CLEAR AS QUARTZ" MIGHT BE A NEW SIMILE

Although details of the winch 30 feet beyond Dr. Beebe's head may be observed through the fused windows, the Bathysphere's eyes are three inches thick and can easily withstand pressures of half a ton to the square inch at a depth of half a mile.

Photographs from Dr. William Beebe

THROUGH THESE WINDOWS DR. BEEBE SAW A STRANGE WORLD

Two men, a powerful searchlight (right), oxygen tanks, air-conditioning apparatus, and scientific equipment made the 4½-foot Bathysphere during a dive as crowded as a sardine can. Dr. Beebe, with head phones and mouthpiece, occupies his customary place at the left.

Photograph by E. John Long

RIGGED FOR A CONTOUR DIVE, THE BATHYSPHERE SUGGESTS A FREAK FROM MARS

In order to study areas where the ocean bottom shelves off to the deep sea, a "box-kite" device is attached at an angle of 45 degrees. A coupling shift gives the Bathysphere a downward slant. The rudders keep the quartz windows pointed forward as the apparatus is towed slowly along.

Photograph from Dr. William Beebe

"STANDARD EQUIPMENT" FOR HOUSEKEEPING IN THE DEPTHS

The tanks with automatic valves contain oxygen; the cans, chemicals to absorb carbon dioxide and moisture. There are chemical trays, telephone, photometer, barometer, spectroscope, notebook, stereoglasses, flashlight, color chart, fan, temperature-humidity recorder, and first-aid kit. The book, Murray and Hjort's "The Depths of the Ocean," Dr. Beebe has taken on all his deep dives.

Photograph from Dr. William Beebe

HERE THE STAFF ATE AND SLEPT

The Bermuda Biological Station, under the directorship of Dr. Wheeler, at St. George West, kindly offered living quarters for the expedition personnel, but research activities were conducted at New Nonsuch, seven minutes' walk to the east.

Photograph by John Tee-Van

PAINSTAKING RESEARCH FOLLOWS EACH DEEP-SEA DIVE OR NET HAUL

The entire staff of New Nonsuch spends hours, and sometimes days, identifying newly found specimens in the laboratory, studying notes, and preparing detailed reports. In this group are, left to right, Dr. William Beebe, John Tee-Van, Jocelyn Crane, Mrs. Else Bostelmann, Gloria Hollister, and (standing) George Swanson.

Photograph by John Tee-Van

FIGURES CHECKED DEPTH MEASUREMENTS

At intervals of 10 feet numerals were painted on the *Ready's* deck along a 100-foot loop of cable leading from the drum to the lower pulley of the supporting boom. A splash of white paint was daubed on the cable as it unrolled from the drum. When the mark had traveled the length of the loop, the winchman knew another 100 feet of depth had been attained.

A pair of large, coppery-sided Scimitar-mouths (*Gonostoma elongatum*) swam past; *Sternoptyx,* the Skeletonfish, appeared in a group of four; a fish as flat as a moonfish entered the beam, and, banking steeply, fled in haste. One flying snail, from among the countless billions of his fellows, flapped back and forth across my glass. Three times, at different levels, creatures had struck against the glass and, utterly meaningless as it sounds, "exploded" there so abruptly that we instinctively jerked back our heads (see text, page 701).

We tried out the full power of the 1,500-watt light, heating the Bathysphere and window considerably, but not too dangerously. At 11:17 o'clock I turned the light on suddenly and saw a strange quartet of fish to which I have not been able to fit genus or family (see Color Plate II). Shape, size, color, and one fin I saw clearly, but Abyssal Rainbow Gars is as far as I dare go, and they may even not be gars.

About four inches over all, they were slender and stiff, with long, sharply pointed jaws. There they stood, for they were almost upright, and I could see only a slight fanning with a dorsal fin. Keeping equal distances apart and maintaining their upright pose, they swam slowly into the uttermost dark.

LIGHTS FLICKER IN THE DEPTHS

I alternated with Mr. Barton's camera at the window and there were hardly any seconds without lights or definite organisms coming into view. In one period, chosen at random, I counted 46 lights, 10 of which were of unusual size, most of them pale yellow but a few bluish.

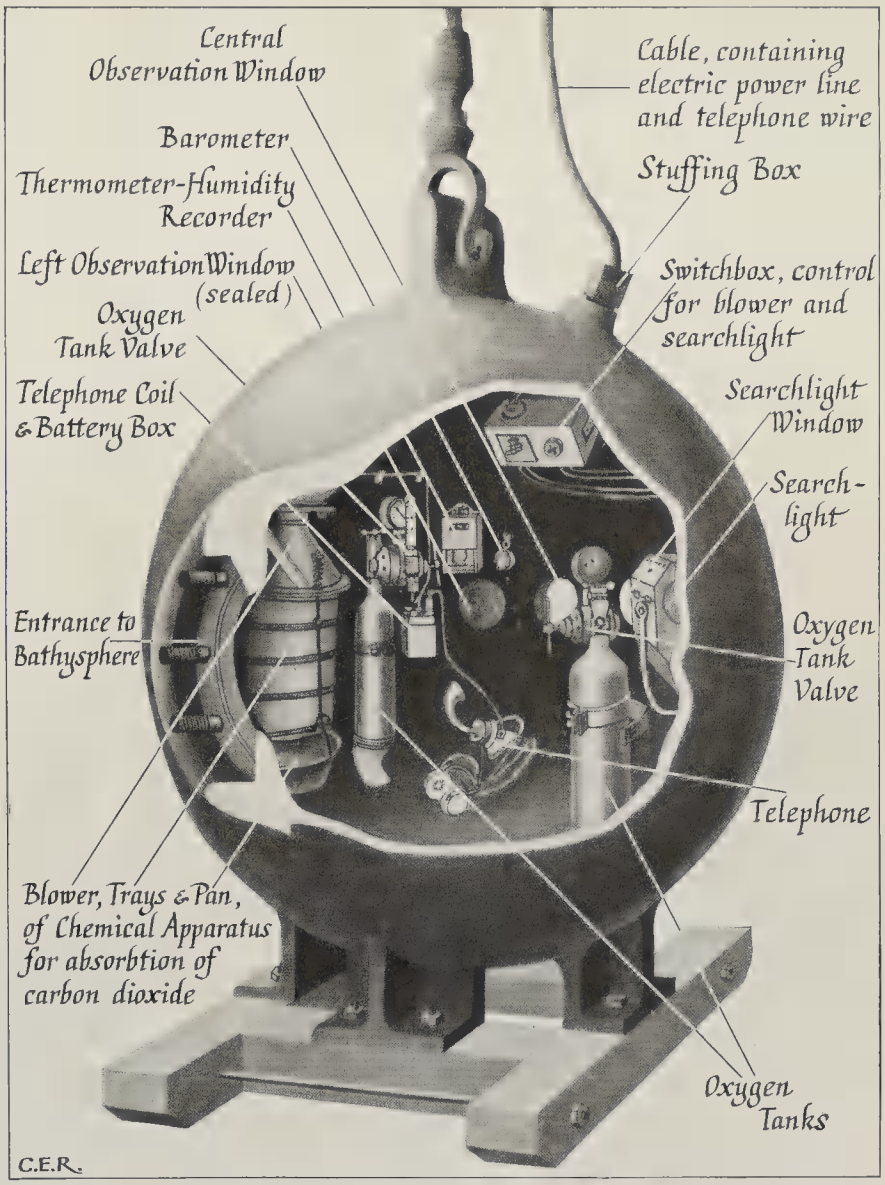
More than two hours had passed since we left the deck, and I knew that the nerves of both my staff and myself were getting ragged. I called for our ascent.

One minute later, at 2,470 feet, all my temporarily relaxed attention was aroused and focused on another splendid piece of luck. A tie rope had to be cut, and in the resultant brief interval of suspension, extended by my hurried order, a new Anglerfish came out of all the ocean and hesitated long enough close to my window for me to make out its dominant characteristics (see Color Plate VII).

I am calling it the Three-starred Anglerfish, *Bathyceratias trilynchnus*. It was close in many respects to the well-known genera *Ceratias* and *Cryptosparas*, but the flattened angle of the mouth and the short, even teeth were quite different.

Six inches long, typically oval in outline, and black, it had a small eye. The fin rays were usual except that it had three tall tentacles, or illicia, each tipped with a strong pale-yellow light organ. No pioneer peering at a Martian landscape could ever have a greater thrill than did I at such an opportunity.

Once more I rearranged my aching limbs. Everything of interest was still relayed through the phone, but I was slumped down, relaxed.



Drawn by Charles E. Riddiford

SPACE WAS AT A PREMIUM WITH ALL INSTRUMENTS ABOARD

Because the Bathysphere is so small and the equipment so scattered into odd nooks, its interior cannot be photographed to show the oxygen tanks, valves, gauges, etc., as they were placed during a dive. The artist's drawing, however, cuts away a bit of the shell and discloses the relative location of each item in this deep-sea laboratory.

A DEEP-SEA "POWER HOUSE"

Suddenly I leaned forward. At a moment of suspension came a new and gorgeous creature.

I yelled for continuance of the stop, which was at 1,900 feet, and began to absorb what I saw: a fish almost round, with long, moderately high, continuous, vertical fins; a big eye; a medium mouth; and small pectoral fins. The skin was decidedly brownish.

We swung around a few degrees, and from the vantage thus gained I saw its real beauty. Along the sides of the body were five unbelievably beautiful lines of light, one equatorial, with two curved ones above and two below. Each line was composed of a series of large pale-yellow lights, and every one of these was surrounded by a semicircle of very small but intensely purple photophores (see Color Plate XII).

The fish turned slowly, showing a narrow profile. If it had been at the surface and without lights I should, without question, have called it a Butterfly-fish (*Chaetodon*) or a Surgeonfish (*Acanthurus*). But this glowing creature was assuredly neither, unless a distant relative adapted for life at 300 fathoms.

My name for it is *Bathysidus pentagrammus*, the Five-lined Constellation Fish. In my memory it will live throughout the rest of my life as one of the loveliest things I have ever seen.

Soon after returning to the surface, I reviewed my telephoned notes, especially of the several new fish of which I had been given such excellent sights. I added all the details that came to mind. Then, with my artist, Mrs. Bostelmann, I went into an artistic huddle, made scrawling attempts myself, then carefully corrected her trained drawings. Little by little my brain fish materialized, their proportions, size, color, lights, fins interdigitated with those of my memory.

RECORD IS FORGOTTEN

In the never-ceasing excitement of abounding life I had completely forgotten the idea of a half-mile record. When on deck, in exactly another hour, we were reminded that an additional 130 feet would have done the trick, I had no regrets. A man-made unit of measure is of far less importance than my Three-starred Angler, which otherwise we should have missed.

As for this particular dive, we started up from the lowest depth, 2,510 feet, with 650 pounds of oxygen left in the tank, and reached the surface just as the last hiss of gas escaped from the valve, and the recording ball settled to rest. Unfortunately for any sensational news value, we had a second valve and full tank ready to use!

We had been sealed up for more than three hours; yet when we stepped out, the air inside was as fresh as that on deck. Our mechanical apparatus had worked without a hitch and was ready for a new dive. In fact, in the afternoon we made an hour's contour dive near shore, and mapped about a mile of Bermuda's slopes some ten fathoms under water.

Sunday we devoted to translating and augmenting our notes with added remembered details and getting everything ready for the next dive. Believing that the best kind of rest is a change of activity, on Monday, August 13, we took the *Skink* and went 10 miles out from shore to North Rock, the last geological remnant of old Bermuda, a jagged sentinel still standing against the beating of the open sea (see map, page 670).

The reefs here are the finest in all these islands, with giant heads of brain coral and sea fans more than eight feet high. Here the fish are correspondingly larger and sharks abundant. Diving in the helmet in seven fathoms at the edge of a magnificent reef, I had the amazing luck to see all the so-called dangerous fish of Bermuda—sharks, barracudas, and green moray eels—within a space of 20 square feet.

All, as usual, were harmless, and only when a five-foot shark stoutly contested the possession of a rare puffer, which I had just stunned with a dynamite cap, was I compelled to bang it on the snout and drive it away. On the last dive five sharks were about and interested in everything I did, but only as vultures are drawn at the sound of a hunter's gun, by the hope of a feast.

The following day we went to sea in the tug *Gladisfen* and drew deep-sea nets across the very place I had dived in the Bathysphere so few hours before. As always, we were delighted with the sight and touch of beings from the icy depths, and at the same time amazed at the meagerness of the haul compared with what I knew of the abundance of life through which the nets had passed. However, each net was filled with glorious creatures, many of which were unknown. Best of all, instant transference into iced salt water revived many of them.

A pair of 10-inch Scimitar-mouths, such as I had seen on the last dive at a depth of 416 fathoms, were alive, and for the first time we had a Black Swallower, *Chiasmodon niger,* swimming full speed about his jar. Unlike most of his kind, he had an empty stomach, not distended with one of his unbelievably enormous meals (see Color Plate IX).

Another treasure was a living, gay-colored, semitransparent, telescope-eyed *Dolichopteryx,* the Long-finned Ghostfish, probably a new species. It was the sixteenth of the whole genus to be taken by man and the first ever to be seen alive.

Day after day weather held good, and Wednesday, August 15, was no exception. At 6:45 a. m. we were arranging to leave St. Georges anchorage, the barge *Ready* with the Bathysphere and ourselves, and the tug *Gladisfen* towing.

THE "EXPLOSION" MYSTERY SOLVED

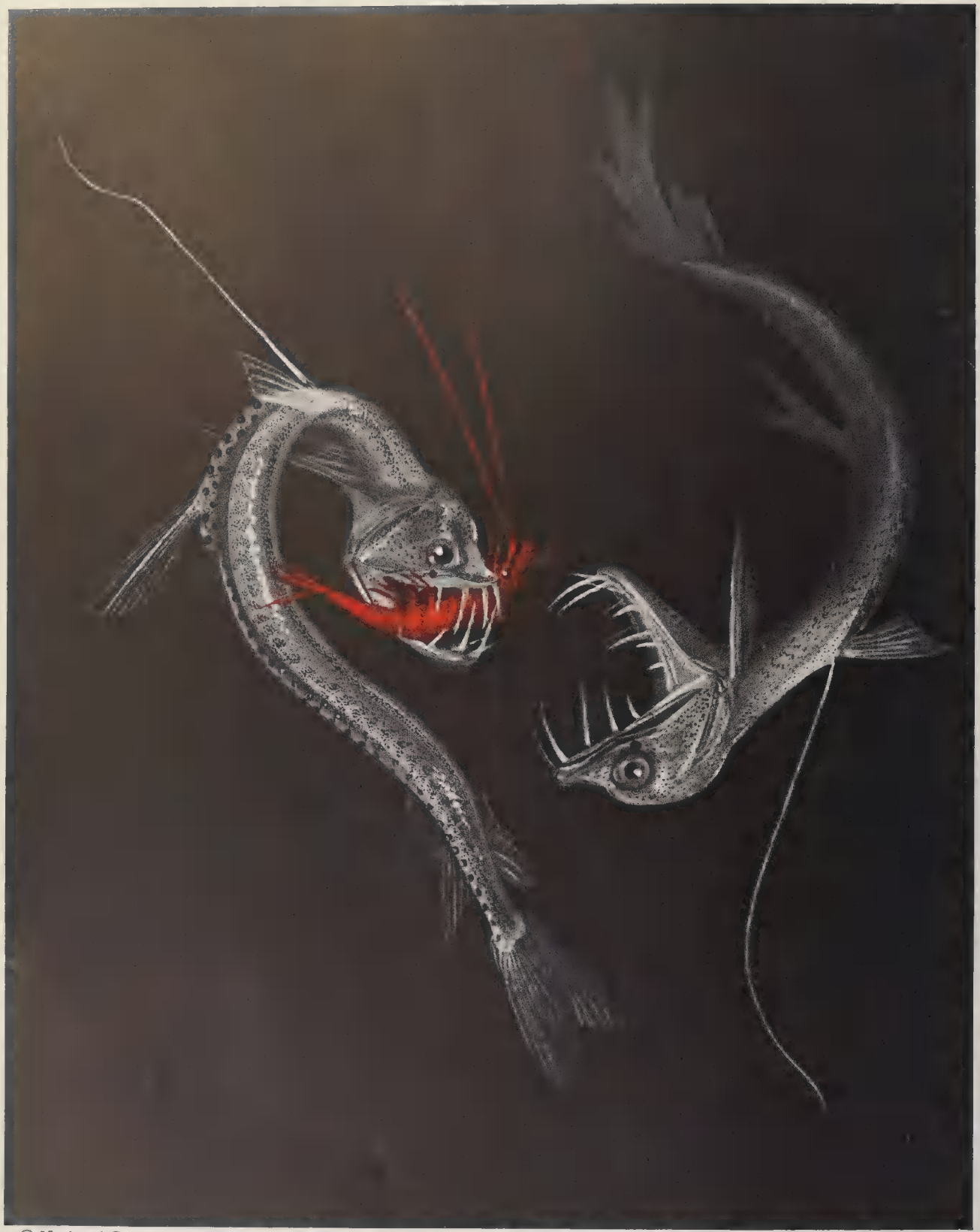
Three hours later Mr. Barton and I were dropped overboard far out at sea. As well as we could determine from sights on the lighthouses, we submerged at the identical spot into which we had splashed four days before.

The same spot, but far from the same visible life. Surprises came at every few feet, and again the mass of life was totally

© National Geographic Society Painting by Else Bostelmann. Natural Size

A DEEP-SEA TRAGEDY DRAMA—IN THREE ACTS!

The Black Swallower (*Chiasmodon niger*) makes a meal of a fish three times its size! Upper left, the smaller fish maneuvers into position; center, the Black Swallower snaps a head-lock on his adversary, a Unicorn Fish (*Bregmaceros macclellandi*); and, lower right, the Black Swallower swims off with the larger fish coiled within its distended stomach. This incident constantly occurs in the depths. By some unknown method of attack the well-named Swallower is able to kill and actually swallow an opponent thrice his length.



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Painting by Else Bostelmann. Five Times Natural Size

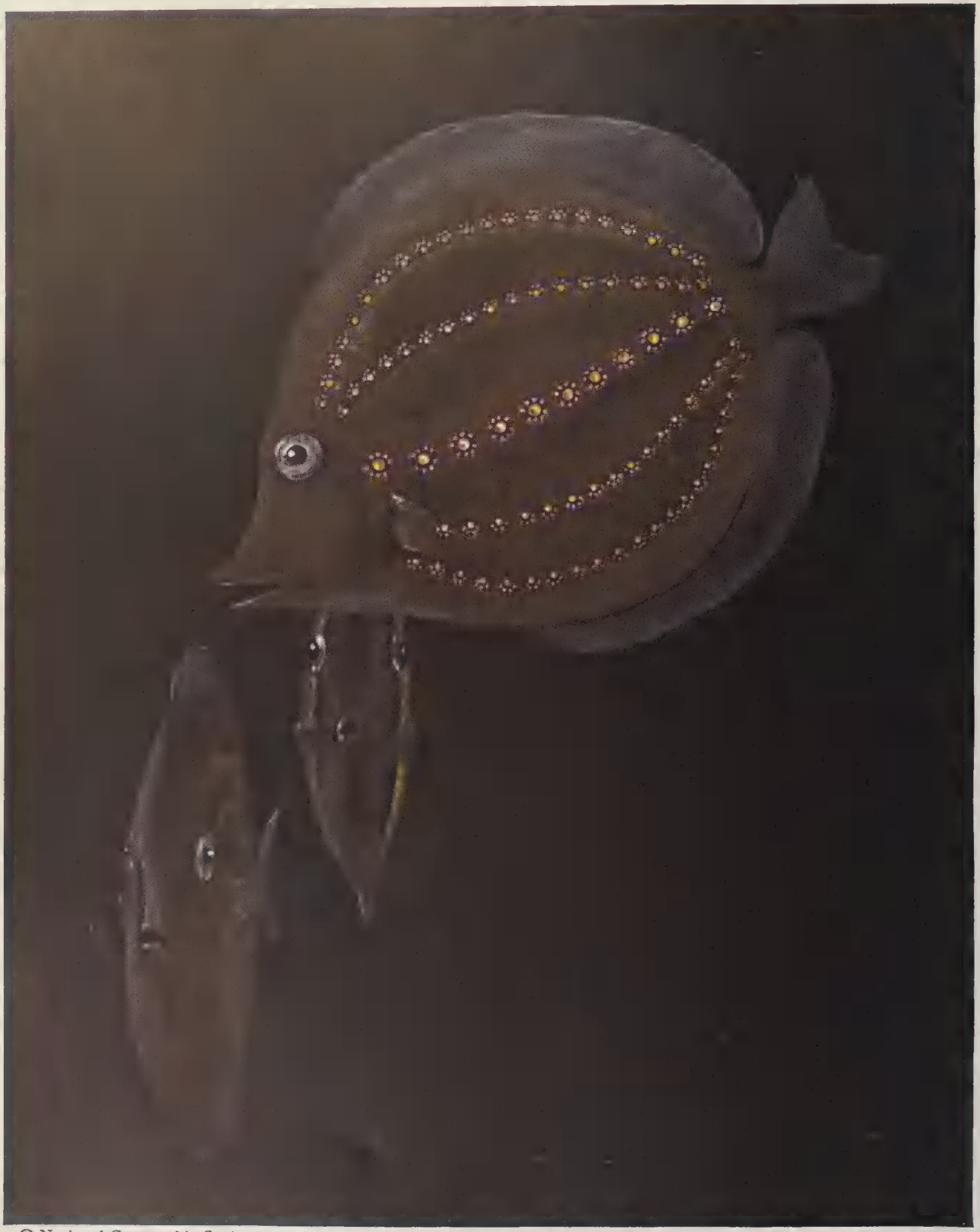
BABY DRAGONS OF THE DEPTHS FIGHT OVER A VICTIM

These two young Saber-toothed Viperfish (see Plate V) are only an inch in length, but Nature has provided them with relatively enormous fangs, which they use with terrible effect in pitched battles hundreds of fathoms down. One of them has seized a Scarlet or Flammenwerfer Shrimp (see Plate XVI), whose dense cloud of protective "flame" did not prevent capture. It will be swallowed whole, and slowly digested.

© National Geographic Society Painting by Else Bostelmann. Three Times Natural Size

THESE ARMORED KNIGHTS OF NEPTUNE BEAR LANCES

During trawling operations from the tug *Gladisfen*, the deep-sea nets have brought up myriads of these thin, delicate crustaceans (*Rhabdosoma*), appropriately known as Needle Heads. They form part of the great world of oceanic life which drifts across the Bathysphere's bar of light like motes of dust in a sunbeam; but until they can be studied in their natural habitat, we can but wonder at their peculiar shape. Science knows nothing of their habits.



© National Geographic Society Painting by Else Bostelmann. Two-thirds Natural Size

BEAUTY FLASHES IN A WORLD OF ETERNAL NIGHT

Brilliantly illuminated as a pulsating aurora borealis, the Five-lined Constellation Fish is one of Doctor Beebe's newest finds. He says of it: "I can only guess that it is distantly related to Butterfly-fish (*Chaetodon*) or Surgeonfish (*Acanthurus*). I had a side and front view of one at 1,900 feet and saw its shape, eye and light organs distinctly, and estimated its length at six inches." Head-on, the Constellation Fish has a sad, rather wistful expression, giving no hint of its brilliant flanks.

© National Geographic Society

Painting by Else Bostelmann. One-half Natural Size

THE LARGEST BERMUDA DEEP-SEA FISH EVER TAKEN IN A NET

Since making his explorations in the Bathysphere, Doctor Beebe is convinced that he captures only the smaller, slow-moving creatures by trawling. "The morons of the deep," he calls them. The Great Gulper Eel (*Saccopharynx harrisoni*), 55 inches long, is the biggest specimen that has yet been brought to the surface from the depths. Here it is devouring a Giant Lanternfish (*Myctophum affine*), probably lured within striking distance by the flaming-red light organ near the tip of its tail.

© National Geographic Society Painting by Else Bostelmann. Natural Size

AN "AIR RAID" HALF A MILE BELOW THE NEAREST AIR!

There is something suggestive of futuristic warfare, or a mass attack by hostile Martians, in this rain of Scarlet Arrow Worms (*Sagitta*), far beneath the surface of the Atlantic. Arrow Worms, whose shape is strikingly similar to that of an aërial torpedo, vary in color, being pale and transparent at the surface and scarlet in the great depths. They feed on small fry and are in turn avidly devoured by such fish as the Tailless Eel (*Cyema atrum*), in the manner shown above. Since there are no plants in this sunless world, every creature is perforce carnivorous.

© National Geographic Society Painting by Else Bostelmann Figures Various Sizes

BIG BAD WOLVES OF AN ABYSSAL CHAMBER OF HORRORS

Often absurdly grotesque are the creatures seen from the Bathysphere. The Telescope-eyed Fish (*Opisthoproctus*), upper left, suggests an aquatic baboon; while the Shining-toothed Angler (*Dolopichthys*), lower left, recalls the Cheshire Cat in "Alice in Wonderland" whose grin was the last part of it to disappear! Others are: upper center, Black Whalelet (*Melanocetus*); upper right, Viperfish (*Chauliodus*); left center, Scarlet-and-gold-lighted Dragonfish (*Malacosteus*); right center, Gulper Eel (*Gastrostomus*); extreme left, Lanternfish (*Diaphus*), and lower right, Pygmy Angler (*Aceratias*).

© National Geographic Society Painting by E. J. Geske. Natural Size

FIGHTING WITH "FLAME" HALF A MILE DOWN

Like *Flammenwerfer* of the World War, the Scarlet Shrimp (*Acanthephyra purpurea*) shoots forth a cloud of luminous fluid to blind its assailant (*Photostomias guernei*). This is as effective a means of defense in the complete darkness of the deep sea as the smoke screen of sepia ink thrown out by squids in clear, shallow water. This defense was noted again and again from the Bathysphere, and, sometimes when the explosion came directly against the thick quartz windows, those within dodged back as from a direct blow.

unexpected, the total of creatures seen unbelievable.

I have spoken of the three outstanding moments in the mind of a Bathysphere diver—the first flash of animal light, the level of eternal darkness, and the discovery and descriptions of a new species of fish. A fourth came to me on this last deep dive, at 1,680 feet, and it explained much that had been a complete puzzle.

I saw some creature several inches long dart toward the window, turn sideways, and—explode! This time my eyes were focused, and at the flash, which was so strong that it illumined my face and the inner sill of the window, I saw a large red shrimp and an outpouring fluid of flame (see Color Plate XVI).

AN ABYSSAL SMOKE SCREEN

Many "dim gray fish" now resolved into distant clouds of light, and all the previous "explosions" against the glass became intelligible. At the next occurrence the shrimp showed plainly before and during the phenomenon, illustrating the value of knowing what to look for.

That a number of the deep-sea shrimp have this power of defense is well known. I have had an aquarium aglow with the emanation. It is the abyssal equivalent of the sepia smoke screen of a squid at the surface.

Another advance in technique was unconscious and only accidentally came to realization. On a succeeding dive I went down 1,500 feet and took Mr. Tee-Van. He wondered at my ability to identify organisms which to him, on this first descent into the dark zone, were only individual lights.

I had learned instinctively to ignore the light as soon as possible and look to left or right of it. Exactly as the spiral nebula in Andromeda can be seen most clearly by looking a little to one side, so the sudden flashing out of a light is less blinding when viewed indirectly, and simultaneously its author may more than likely come into focus.

At 1,800 feet I saw a small fish with illumined teeth, lighted from below, with distinct black interspaces; and 10 feet below this my favorite sea dragons, *Lamprotoxus,* appeared, they of the shining green bow (see Color Plate V, National Geographic Magazine, January, 1932). Only 16 of these fish have ever been taken, and seven of these came up in our own nets. The record size is about eight inches. Here before me were four individuals all more than twice that length and probably representing a new species.

At 2,100 feet two large fish, quite three feet over all, lighted up and then became one with the darkness about them, a tantalizing glimpse which made me more than ever long for bigger and better nets.

A very large, dim, but not indistinct outline came into view at 2,450 feet for a fraction of a second, and at 2,500 feet a delicately illumined ctenophore jelly throbbed past. Without warning, the large fish returned, and this time I saw its complete, shadowlike contour as it passed through the farthest end of the beam. Twenty feet is the least possible estimate I can give to its full length, and it was deep in proportion.

For the majority of the "size-conscious" human race this marine monster would, I suppose, be the supreme sight of the expedition. In shape it was a deep oval; it swam without evident effort, and it did not return. That is all I can contribute, and while its unusual size so excited me that for several hundred feet I kept keenly on the lookout for hints of the same or other large fish, I soon forgot it in the (very literal) light of smaller but more distinct organisms.

What this enormous creature was I cannot say. A first and most reasonable guess would be a small whale or blackfish. We know that whales have a special chemical reaction in their blood which makes it possible for them to dive a mile or more and come up without getting the "bends." This depth of 2,450 feet would be paltry for any similarly equipped cetacean. Less likely, it may have been a whale shark, which is known to reach a length of 40 feet.

VISION OFTEN TRICKED

Any one who from an airplane high above the earth has tried to spot another plane somewhere near, in full view, will appreciate the even greater difficulty of focusing, in this three-dimensional, Stygian blackness, upon some creature suddenly appearing six inches from our faces or 45 feet away. Again and again, before the eye can refocus, the flash and its owner have vanished.

Mr. Barton saw no trace of the large creature I have mentioned, although I called out to him and got him at the window immediately. Soon after, when we were both looking out, he saw the first living *Stylophthalmus* ever seen by man, which completely escaped me, although it must

Photograph by John Tee-Van

THE WINCH TOLD THE STORY

Not satisfied with the official record kept by Miss Crane, the man in charge of this equipment kept his own score with chalk (see illustration, page 690). It checked exactly—3,028 feet! The winchman sits beside his reckoning board between Capt. James Sylvester (commander of the *Ready*) and Dr. Beebe.

have been within a foot of the window. This is one of the most remarkable of deep-sea fish, with eyes on the ends of long periscope stalks, almost one third as long as its body.

My missing the fish was all the more disappointing because I had recently been thoroughly studying these strange beings, and in fact had "abolished" their entire family after proving that they were the larvæ of the Gleaming-tailed Serpent Dragons, *Idiacanthus* (see Plate IV, National Geographic Magazine, January, 1932).

THREE THOUSAND FEET DOWN

At 11:12 a. m. we came to rest gently at 3,000 feet, and I knew that this was my ultimate floor; the cable on the winch was very near its end. A few days ago it had appeared blacker at 2,500 feet than could be imagined, yet now to this same imagination it seemed to show as blacker than black. It seemed as if all future nights in the upper world must be considered only relative degrees of twilight. I could never again use the word *black* with any conviction!

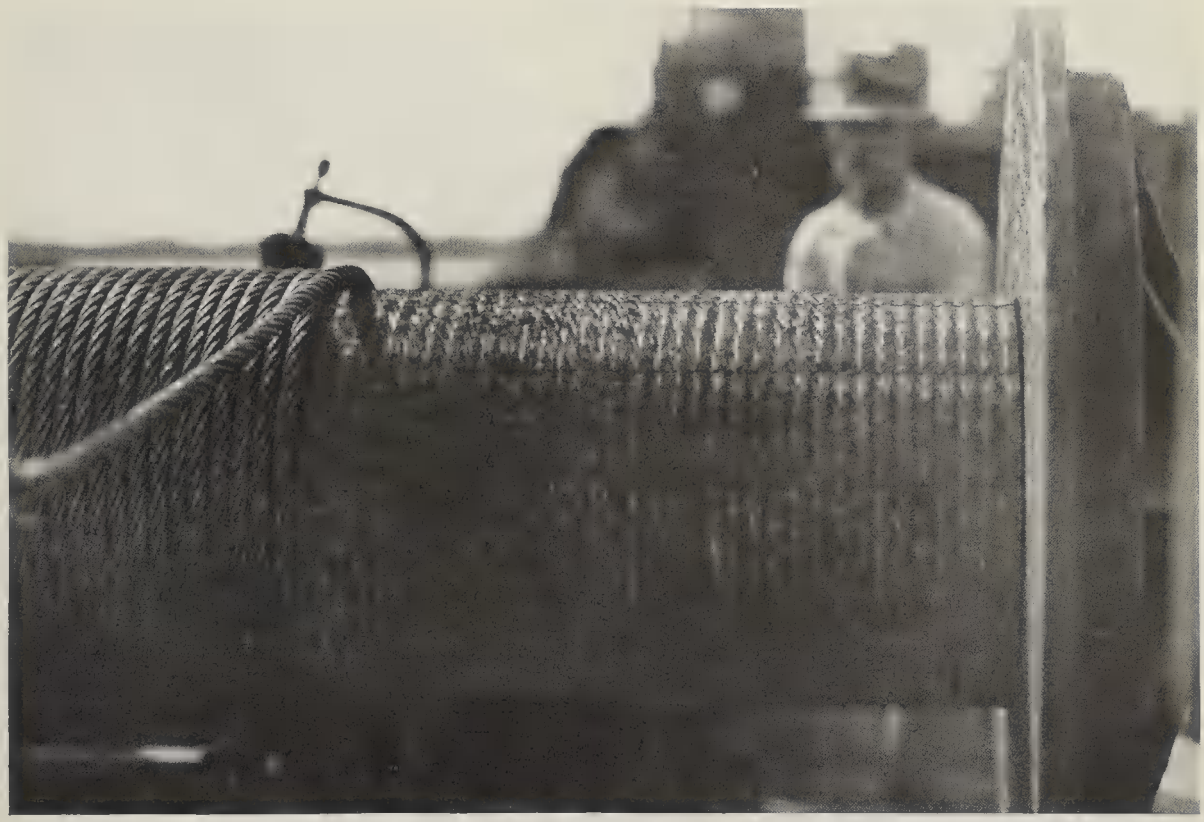
I looked out and watched an occasional passing light and for the first time I realized how completely lacking was the so-called phosphorescence with which we are familiar at the surface. There, whenever an ordinary fish passes, it becomes luminous by reflection from lights of myriads of minute animals and plants floating in the water. Here each light is an individual thing, often under direct control of the owner.

A second thing which occurred to me as I sat coiled in the Bathysphere, *more* than half a mile down, was the failure of our powerful beam of light to attract organisms of any kind. Some fled at its appearance; others seemed wholly unconcerned, but not a single copepod or worm or fish gathered along its length or collected against the starboard window from which it poured.

QUIET BROODS IN THE DEPTHS

Even in this extremity of blackness I sensed the purity of the water, its freedom from sediment and roiling; six miles from shore and a full mile above the bottom insured this.

There was no diffusion of light, no trails, no refraction. When sparks or larger lights



Photograph from Dr. William Beebe

ONLY A FEW TURNS LEFT ON THE DRUM!

With the naked wooden case showing and a strain of nearly four tons on the supporting cable, Capt. James Sylvester, in charge of the *Ready,* refused to let out any more wire when 3,028 feet was reached on August 15. Creaking and groaning, the cable, still wet, gave off sparks as the strands were ground together during rewinding.

moved, they were as distinct as when they were motionless. But reflection was noticeable, as upon the eye or skin from a subocular or a lateral photophore, or upon my face when a Flammenwerfer Shrimp "exploded" close in front of me (see Color Plate XVI).

Now and then I felt a slight vibration and an apparent slacking off of the cable. Word came that a cross-swell had arisen, and, when the full weight of Bathysphere and cable (nearly four tons at this depth) came upon the winch, Captain Sylvester let out a few inches to ease the strain. There were only about a dozen turns of cable left upon the reel, and a full half of the drum showed its naked, wooden core. We were swinging at 3,028 feet, and would we come up? We would.

MORE BIG FISH AT GREATER DEPTHS

Whatever I thought about the relative value of intensive observation as compared with record-breaking, I had to admit that this ultimate which we had attained showed a decided increase in the number of large fish—more than a dozen from three to twenty feet having been seen—and a corresponding greater number of lights, though not in actual size of their diameters.

Before we began to ascend, I had to stop making notes of my own, so numb were my fingers from the cold steel of the window sill. To change from my cushion to the metal floor was like shifting to a seat on a cake of ice.

WATER LOOKS HARMLESS FROM INSIDE

Of the blackness of the outside water I have already written too much. As to pressure, there *seemed* no reason why we should not be outside in a diving helmet.

I thought of a gondola 60,000 feet up in the stratosphere with a pressure of one pound to the square inch.* And then, through the telephone, we learned that at this moment we were under a pressure of 1,360 pounds to each square inch, or more than half a ton. Each window held back more than 19 tons of water, while a total of 7,016 tons was piled up in all directions

* See "Exploring the Stratosphere," by Capt. Albert W. Stevens, in the NATIONAL GEOGRAPHIC MAGAZINE for October, 1934.

Photograph by David Knudsen

AIR-CONDITIONING IS NOTHING NEW TO BATHYSPHERE DIVERS

The trays of soda lime and calcium chloride now on deck absorbed carbon dioxide and water vapor given off by the crew within the confined quarters of the iron ball during descent. Fresh oxygen was supplied at the rate of a liter a minute and a small electric blower kept the air in circulation. Inspecting the trays after a dive are, left to right, John Tee-Van, Perkins Bass, and Dr. Beebe.

upon the Bathysphere itself. Yes, we had heard clearly, and we told them we were ready to be pulled up at once!

At 2,929 feet I heard a metallic twang through the phone, and when I asked what it was I got some noncommittal answer. I found out later that one of the guy ropes used in spooling the incoming cable on the drum had suddenly given way with a terrific report—a ghastly shock to everyone on deck until they realized it was an auxiliary rope and not the cable. Truly, we in the Bathysphere had the best of it at all times.

The only other place comparable to these marvelous nether regions must surely be naked space itself, out far beyond atmosphere, between the stars, where sunlight has no grip upon the dust and rubbish of planetary air, where the blackness of space, the shining planets, comets, suns, and stars must really be closely akin to the world of life as it appears to the eyes of an awed human being in the open ocean a half mile down.

HUNTING USEFUL PLANTS IN THE CARIBBEAN

By David Fairchild

Agricultural Explorer, United States Department of Agriculture

Author of "Hunting for Plants in the Canary Islands," "The Jungles of Panama," "A Hunter of Plants," etc., in the National Geographic Magazine

AN UNINHABITED island! What a thrill the words bring. And to land on one in the Tropics is the experience of a lifetime. It is like going down under the sea, or standing on the rim of a crater, or going up in a balloon, or falling in love.

As the boat neared the deserted little island of Beata we searched the skyline with our glasses, wondering what sorts of plants were there, for we approached it not as Crusoes, but as plant explorers for the United States Department of Agriculture.

SEEKING NEW PLANTS, NEW FOODS

On Mr. Allison V. Armour's research yacht *Utowana* we were cruising the Caribbean for drought-resistant plants, for new foods to enrich the American menu, for any valuable member of the vegetable kingdom which might conceivably flourish on our shores.

In the Bahamas we had sought in vain the wild type of cotton from which the sea-island cotton came,* but had gathered hundreds of frangipanis, those exquisite, fragrant-flowered trees which are native there, although more generally associated with oriental graveyards and South Sea islands.

We had passed through the Windward Passage between Haiti and Cuba, bound for Beata, off the southwest coast of the Dominican Republic, and now that tiny isle lay before us, green and inviting (see Special Map Supplement with this issue of The Geographic). Above the other vegetation waved what seemed like slender bamboo stems with tufts of leaves at the top. First to detect them was Harold Loomis, of the Department's Division of Plant Exploration. Could there be a native bamboo here? Not at all likely, for none of the tall bamboos of slender habit are denizens of the West Indies.

Each turn of the propeller made these objects clearer, and gradually they stood out plainly as the slender stems of a fascinating palm, new to the books and possibly new to science.

Was it in fruit? How tall was it? Would it become some day a palm for our gardens in Florida, or perhaps an ornamental house palm? Of course Loomis was the most anxious to get ashore, for he was the palm man of the party.

Mr. Armour was at the wheel. He had landed once before on this same island, and as we neared the shore he admonished us of the ways it might best be explored. Nevertheless, with a mad rush we all made for the new forms of trees and shrubs on the rocky cliffs and instantly became entangled in almost impenetrable thickets of spiny vegetation. Had the ground been passably level, we could have cut our way through, but we walked on knifelike edges and needle-sharp pinnacles of eroded limestone rocks which, even if there had been no vegetation at all, would have made going tedious.

When we had exhausted ourselves in the first rush, we drifted back to the shore with our booty and worked our way along the shelf of rocks, walking over countless ancient conch shells which lay in windrows on the old elevated beach, until we heard Loomis, who had made for the cliffs above in search of his palm, scrambling down to the shore.

He appeared dragging it with him and stood it up beside him for me to photograph (see illustration, page 710).

ONE SPECIES KNOWN, ANOTHER NEW

Until we brought it back to America, we fondly hoped it might be new to science. However, that genius of a collector, the Swedish naturalist, Ekman, had discovered it in Haiti. From the seeds we collected there are now many little palms growing in a greenhouse in Florida.

Now that the world has been thoroughly combed over by scientists, it is rather rare to discover a new plant, as our experience with the palm shows. Yet on this same lonely island we made such a find.

Our prize was a fine ornamental tree about 20 feet high, related to the hibiscus

* See "The Golden Isles of Guale," by W. Robert Moore, in the National Geographic Magazine for February, 1934.

Photograph by P. H. Dorsett

RED FRUIT LURES A PLANT-HUNTER UP A TREE

It is a hard climb, but Harold Loomis was rewarded by getting the first living seeds from Cook's Saona Island palm, which now may add its splash of color to subtropical gardens and conservatories. Although the fruit is not edible, the author enjoyed the taste of a chip from the trunk. He suspects that if it were in the Orient the tree, like the sago palm, might be used for starch.

and bearing cream-colored flowers the size of large saucers. Dr. Frederick L. Lewton, of the United States National Museum, who has specialized on the family to which it belongs, has found it to be a new genus and has named it for Mr. Armour—*Armouria beata.* Unfortunately, only two of the seeds we collected from it have grown.

We cut our way through the brush without realizing that it was overgrown with manchineel trees, but the effects of the oil glands of their leaves soon reminded us that the West Indies has poisonous trees worse than our familiar poison ivy. In former days the manchineel was believed to be as deadly as the famous upas tree of Java.

There is a strange fascination in making your way slowly and painfully through the scrub, pushing against the tangle of vines that catch at your clothes and your flesh, cutting down a small tree here, or hacking a trail through some spiny bush there, watching all the time to see that you don't turn your ankle on some sharp rock or plunge your foot into some pothole and break a leg.

But another island awaited us—Saona, off the southeast coast of Hispaniola. We knew of it through a curious circumstance.

My friend, Dr. O. F. Cook, in his investigations in the National Museum in Washington, had come upon a fragment of a palm specimen collected there years ago. Observing characters on it which made him believe it was new, he had named it *Pseudophoenix saonae,* for the island.

He had never seen the living palm, nor had we; but when the boat came within half a mile of the coast of Saona, and we espied through our glasses a splash of red against the dark foliage, we presumed it was a bunch of red fruits of the palm that Cook had described (see illustration above).

This scarlet spot on the landscape was the objective of our first landing on the island. Although we found also a beautiful strand tree, with glossy foliage and fragrant flowers, and collected quantities of seeds of a rather rare palm with huge fan-shaped leaves, it is the memory of that scarlet-fruited palm of Cook's which makes me want to return to the little island.

Photograph by P. H. Dorsett

THE "UTOWANA" ANCHORS OFF A ROBINSON CRUSOE ISLE

Few scenes in all the West Indies have more charm than those about Man-of-War Bay, Tobago, whose scenery some see reflected in Defoe's immortal tale (see text, page 723). Its isolation from the outside world, its rocky cliffs covered with orchids, its densely forested hills, full of palms and epiphytes, the boom of its restless surf—all combine to make it a fitting abode for romance.

It was afternoon, and the long shadows through the forest gave it a strange, fairy-like appearance. As we crept through the undergrowth, here and there, staring at us with their beadlike eyes from the moist forest floor, were giant hermit crabs, bright vermilion in color, the largest I had ever seen. I could not help collecting some to take back as pets to friends in Washington.

Loaded with the palm's brilliant red fruit clusters, each about all a man could carry, we returned to the yacht and hung them up to ripen on their stems on the after hatch. As I write, three years from that afternoon, it is a satisfaction to know that there are boxes filled with little seedlings of Cook's palm at the Introduction Garden in south Florida, and that some day their clusters of scarlet fruit may brighten private gardens and solaria.

HERE A FOREIGN POWER FIRST SALUTED AN AMERICAN FLAG

Rough weather prevented us from landing on the volcanic island of Saba, and we went ashore instead on near-by St. Eustatius, another of the Dutch West Indies. There, in 1776, a Dutch governor ordered the first salute fired to an American flag by any foreign power (see illustration, page 711).

We visited the only remaining bit of virgin forest left in the island, climbing an extinct volcano to do so. After the low brush of the Bahamas, and even the taller forests of Beata and Saona, the rain forest of the crater seemed marvelously rich. Great aroids and ferns formed the undergrowth, and tall leguminous forest trees were hung with lianas of all sorts.

The peak of Mount Misery, on the island of St. Kitts, rose from the sea at dawn next day. A dark cloud on the horizon grew as we approached until it became a mountainous island, so high as to require a day to scale it, with roads, villages, forests, and vast fields of sugar cane. With our glasses we watched the early-morning activities of the countryside; we even heard the cocks crowing, the church bells ringing, and the neighbors talking. The effect might be likened to a fine pastorale.

Photograph by H. F. Loomis

SCIENTISTS EXPLORE WHERE SMUGGLERS ONCE ANCHORED

While eager youngsters watch, the plant-hunting yacht *Utowana*, in contrast with an old three-master, moors off Orange Town, St. Eustatius. In American Revolutionary times this small Dutch island was the center of a huge trade in munitions and supplies for the Colonies, and when, in 1781, a British fleet under Rodney captured it, the contraband was sold at auction.

Photograph by Jacob Gayer

HEAD-CARRYING LEAVES THE HANDS FREE FOR TALKING

Although England has held the island of St. Lucia for more than a hundred years, its Negroes mainly speak a French patois, now gradually giving way to English. Gay kerchiefs serve as pads beneath the baskets and add a touch of color as market-bound women stride along mountain roads or pause on the streets of Castries for a bit of animated conversation (see page 715).

Photograph by Richard B. Hoit

THE VIVID BLUE AND GREEN WATERS OF NASSAU HARBOR GLEAM TWO HOURS BY AIR FROM MIAMI

Off at the left stretch the white bathing beaches of Hog Island, once a pirate lair. Tradition says that in its lee the notorious "Blackbeard," Edward Teach, playfully set fire to a ton of brimstone in his ship's hold and bragged that he stayed in his own little inferno longer than any member of his cutthroat crew. On the coral strand of New Providence Island, at the right, lies Nassau, metropolis of the Bahamas. There the visitor gets a foretaste of Caribbean life.

Photograph by Dr. David Fairchild

ON A TINY ISLE GROWS THE EKMAN PALM, "CROOKED AS A DOG'S HIND LEG"

This rare specimen was dragged from the rocky cliffs of uninhabited Beata by Harold Loomis, who holds it (see text, page 705). Constant bowing before Caribbean winds has given it a permanent crick in its neck, but even hurricanes seem powerless to destroy it. One of the world's slenderest, it is 27 feet tall and not much larger at the base than a tennis racket handle. In sheltered places it grows straight as a flagstaff.

Photograph by H. F. Loomis

HERE BOOMED THE FIRST FOREIGN SALUTE TO AN AMERICAN FLAG

From a cannon such as these the Dutch governor of St. Eustatius ordered a salute fired when a vessel from Baltimore sailed into Orange Town harbor in November, 1776, proudly flying the Grand Union colors. The American Colonies were not yet recognized as an independent nation, and for his act the governor was recalled.

By the following noon we were in the dense rain forest on the slopes of Mount Misery with Harold E. Box, an entomologist, and two of his friends, collecting palm seeds and aroids, and listening to entertaining accounts of island vegetation.

It was strange to find many sorts of tropical fruit trees, which must have been introduced in times past from the Orient and other places, growing wild in the mountains. From the size of their trunks we knew they had been there for a half century or more.

A sense of the age of the West Indies civilization came over me during our first morning in St. Kitts. Suddenly I realized that there was nothing untamed or primitive about the landscape. So far as virgin forest was concerned, I might as well have been walking in New Jersey pastures.

No wonder I felt thus; for by 1630 there had been 6,000 English settlers on the island. The record of nearly 200 years of fighting between the French and English for its possession shows the importance that was placed upon these little tropical islands by the nations of Europe.

I read in a colonial history, written in 1837, that even in those early days there were growing on the island the orange and the shaddock, the latter called after a captain who is said to have brought it from Africa. The history mentions also the "avocato," the grenadilla, and the "forbidden fruit," which is "a species of the shaddock, only smaller and more delicate, while the outer skin is less coarse."

It seems possible from this description that the "forbidden fruit" of the early chronicler was the same as that which the Florida "crackers" rather stupidly named the "grapefruit," and that it originated as a seedling somewhere in these West Indian islands.

The stretches of sugar cane which almost cover the island of Antigua with monotonous pale green looked discouraging from the boat. But with the aid of Mr. C. F. Charter, an enthusiastic young Englishman, we found a pretty yellow-flowered *Cipura,* a scarlet-flowered *Galactia,* two palms, and a tabebuia tree, all of which may some day come to light in our Southern States.

Photograph by José Anjo

HERE LORD NELSON'S FIGHTING FLEET FITTED FOR ACTION

Massive pillars mark the site of the famous admiral's dockyard on the island of Antigua and take the visitor back to the days when the Caribbean was the main arena of naval struggles for supremacy in the New World.

As we approached Dominica at sunrise, it was very beautiful and very tropical, with mist-covered mountain peaks more than 4,000 feet high, and deep, mysterious, almost sinister, gorges. It is a horseback country; had it been better supplied with roads we could have seen more of it.

However, if there had been nothing in Dominica but its botanic garden, we should have been repaid a hundredfold for the days passed there. It has one of the most attractive tropical gardens in the world.

"THE PRINCES OF THE PLANT WORLD"

The glory of such a garden lies in its palms. Those who have seen them only as potted plants cannot appreciate that they are, as Linnæus called them, "the princes of the plant world."

They form an immense family of perhaps 2,000 species, ranging in size from dwarfs to giants 130 feet tall.

Countless generations of primitive children have grown up beneath their shifting shadows; myriads of people for thousands of years have lived on their fruits, built houses from their leaves, made weapons and tools from their stems, and dressed in their leaves. The cargo ships which ply the tropical seas carry palm products to the factories of the Temperate Zone, and in increasing volume the palms help feed and wash mankind with their fats and oils.

I wandered all over the Dominica garden with Mr. Joseph Jones, its creator, and, since we had been offered seeds of the several species of palms, I felt that we had found a veritable mine of material.

Palm seeds are difficult to transport, for many of them do not hold their vitality long. Though the seed itself may be hard and firm, the almost microscopic plantlet which is packed away neatly in the hard kernel is as perishable as a sprouted mustard seed. It will not stand drying out, nor has it any resistance to the molds that are almost sure to gather around the usually oily palm seed-coats.

AIRPLANES AID PLANT IMMIGRANTS

With the facilities afforded by the research yacht we were able to care for the palm seeds given us, and thousands of seedlings, now safely growing in Florida, speak

Photograph by Jacob Gayer

LIFE IN ST. JOHNS MOVES IN THE TEMPO OF THE OLD SOUTH

Wherever he has settled in the New World, the Negro has used the basket and the donkey or the mule for transport. On this British island of Antigua human heads still bear incredible loads and tiny donkeys look as if they should change places with their riders.

for the facilities which Mr. Armour put at our disposal. Also, by air express Mr. Armour landed perishable seeds in Washington in less than six days from the time the seeds were gathered from the trees in British Guiana. I remembered how many of my collections made in the West Indies in 1898 had been dead when they arrived in Washington after a month or more in the steaming hold of some passenger ship.

The rarest and one of the loveliest flowering trees is here in the Dominica garden. *Baikiea insignis* is its name. To stand beside one of the large flower clusters and wait for dusk, and then to watch the slow unfolding of those immense paper-thin petals of ghostly white, fringed with thin bands of old gold; to see these emerge from long finger-shaped buds, soft, velvety, and deep brown as a lady's suede glove, is an experience never to be forgotten.

A ROAD TO A BOTANIST'S PARADISE

On the charming island of St. Lucia the roads, far superior to those of Dominica, wind among amazing scenes of tropical vegetation. In the central mountain region these scenes reach a climax. I do not remember having seen more nearly perfect tree ferns and heliconias, aroids, and bamboos, than along a stretch of the highway there.

COLLECTING OFFERS EXCITEMENT

Howard Dorsett, Loomis, and I passed a day collecting in the mountains and saw the pink and brown fruit clusters of the tall Euterpe palm, which pushed up through the forest below us. To climb down the slippery slopes of a tropical hillside is exciting, for a sheer drop may lie right ahead where some fascinating find lures.

The market at St. Lucia was full of the largest and most attractive dasheens I have seen. This delicious vegetable, the tuber of a plant related to the calla lily, appears to be one of the staple foods of the inhabitants. Some road workers along the way were eating their lunch as we passed. I peeped into their dinner pails and baskets and found that almost all were eating large slices of boiled dasheen.

Mr. Armour and I selected the best specimens we could find in the market,

Photograph by Dr. Karel Domin

HUGE CACTI ADD A BIZARRE TOUCH TO ST. KITTS SCENERY

Such growths are commonly associated in the popular mind with deserts, but they are to be found in wet lands, too. They are sometimes used for fences, and when their huge white blooms open on moonlight nights they make an unforgettable sight. Some regions in Jamaica are literally infested with this giant, which has become a weed.

Photograph by P. H. Dorsett

HACKING DOWN A 100-POUND CLUSTER

Perched on a dead leaf of the Mauritia palm, 50 feet up in a vast tropical swamp, a native swings his machete until the mahogany-colored fruit plunges into the shallow water. Small palms from the seeds gathered near Georgetown, British Guiana, are growing in south Florida, but whether they can adapt themselves to the alkaline conditions of the Everglades is a question.

Photograph by Capt. Albert W. Stevens

DEADLY SNAKES ONCE INFESTED THE VERDURE-COVERED MOUNTAINS OF LOVELY ST. LUCIA

Now these lurking perils, including the venomous fer-de-lance, or "yellow viper," have been virtually wiped out with the aid of the devastating mongoose. The author's plant-seeking party roamed in safety through tropical forests filled with graceful palms and tree ferns. At the left, Castries, the capital, nestles at the head of its superb landlocked harbor. Around it, on land and sea, centered for years the struggle of the French and English for supremacy in the West Indies.

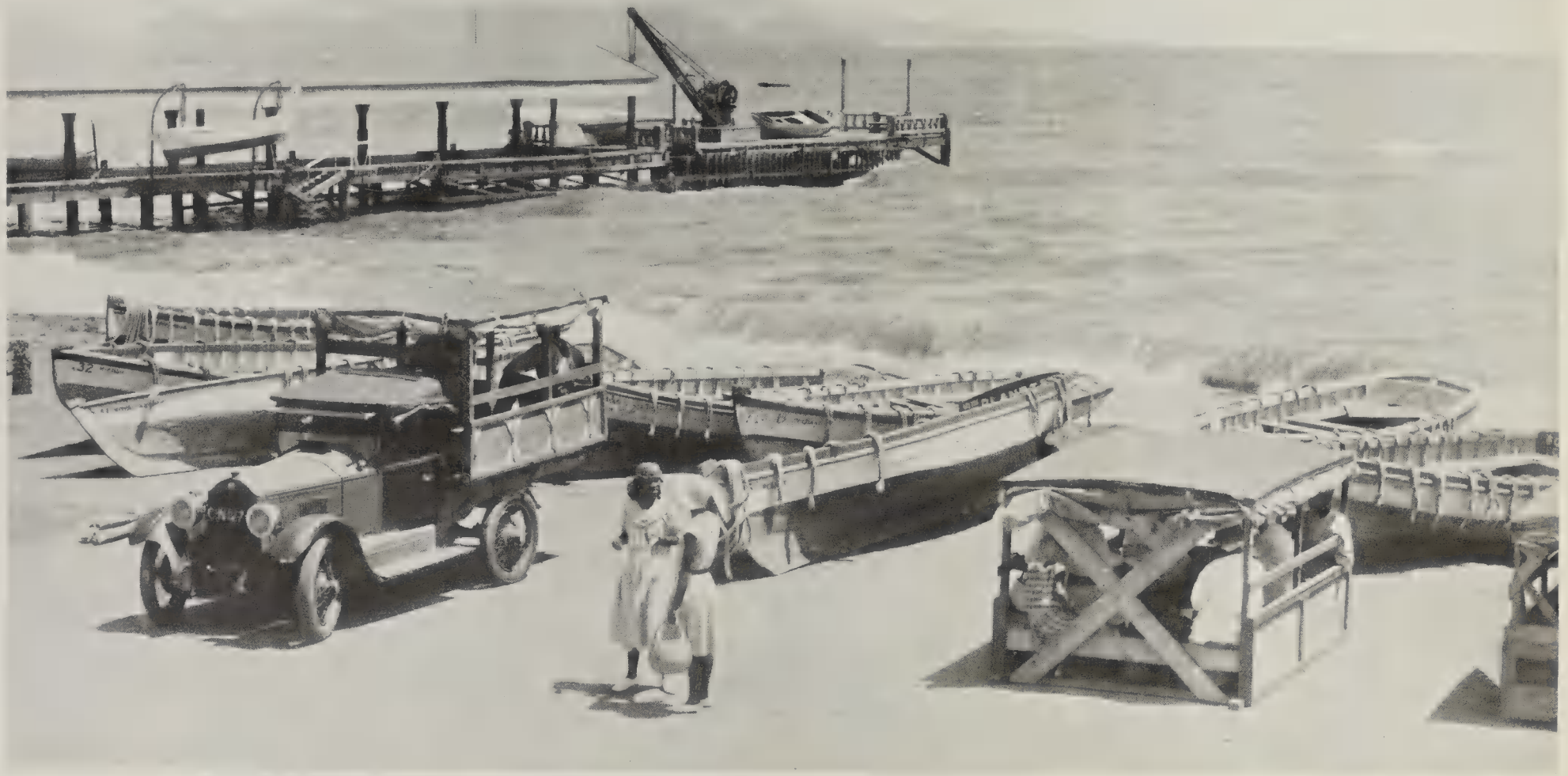
Photograph by José Anjo

ON ST. VINCENT'S BEACHES BLIGH LANDED HIS BREADFRUIT TREES

Photograph by Dr. David Fairchild

IN A SINGLE AFTERNOON ONE CAN RAMBLE ALL OVER TINY MAYERO, IN THE GRENADINES

Its white sand beach sparkles in the sunshine, but, alas, it is bordered with poisonous manchineel trees, which raise blisters more troublesome than those from poison ivy.



Photograph by Ella Barnett

COLUMBUS CALLED THIS ISLAND SAINT CHRISTOPHER, BUT THE NICKNAME "ST. KITTS" HAS STUCK

Basseterre's boat-strewn water front is the end of the line for busses, which bring passengers from the interior in the morning. On arriving here, the body, with its seats, is removed and serves as a waiting room, while the chassis is used for local hauling jobs around the city. On the sands at the right squats one of these removable bodies, well filled with passengers for the return trip in the afternoon. One of the girls in the foreground crochets as she talks.

Photograph by Jacob Gayer

BREADFRUIT CAME AS AN IMMIGRANT FROM THE SOUTH SEA ISLES

This tree at Castries, on St. Lucia, recalls that in 1793 Lieutenant Bligh of the British Navy brought some to the West Indies, despite the famous mutiny of the *Bounty* and his subsequent 3,600-mile voyage in a small boat, after being set adrift by the mutineers. Boiled and served with butter as a vegetable, the fruit tastes like a rich and delicate potato, but it does not take the place, as experimenters once hoped, of bread (see text, opposite page).

Photograph by Dr. David Fairchild

NATURE SUPPLIES EXCELLENT UMBRELLA SUBSTITUTES

As these children of St. Lucia trudged home in the rain, they protected themselves with three-foot *Cocoloba pubescens* leaves, which when the tropical downpour ceased served equally well as parasols. Trees of this species are now growing in south Florida, and plants of it in tubs have been exhibited at the New York Flower Show.

and for days afterward Ernest, the steward, served us with masterpieces of dasheen chips, dasheen stuffing for poultry, baked, scalloped, and boiled dasheens, and so on. He realized the possibilities of the dasheen for many dishes for which the potato is less well suited, and prepared recipes which I sent to the Dasheen Growers Association at Callahan, Florida.

Thanks to the enthusiasm of Mrs. C. W. Doorly, the wife of the Administrator of St. Lucia, our gardens in Florida are being enriched with a new root vegetable called the "lleren," or "topi-nambour," *Calathea allouya*. The little tubers of this plant are sold in small bunches at the market in St. Lucia and some of the other islands. They are the size and shape of pullets' eggs and are usually boiled by the country people before they are taken to market, but we found them more delicious if baked and served hot, like baked potatoes.

St. Vincent boasts the first government-established botanic garden in the Western World, dating from 1763. It became one of the finest gardens in the Tropics; but, because of political difficulties and perhaps misunderstandings, it was abandoned after 50 years, and the plants were moved to Trinidad.

ODYSSEY OF THE BREADFRUIT

It was into Jamaica and St. Vincent that Lieutenant Bligh introduced the breadfruit and many other oriental trees collected on a subsequent expedition to Tahiti after the mutiny of the *Bounty* (see opposite page).

If the Negro laborers of the "sugar colonies" could be fed on breadfruit, it was thought it would be unnecessary to import so much flour and other expensive foodstuffs from Europe.

The planters of Jamaica gave Bligh an enthusiastic welcome and presented him

Photograph by P. H. Dorsett

A FEW CANDIES MADE THE AUTHOR THE PIED PIPER OF TOBAGO

Word traveled fast, and every child in Charlotteville turned out to get his share of the sweets brought safely ashore despite a spill of the landing party into the surf of Man-of-War Bay (see text, page 723). Both the author (left center) and Mrs. Fairchild (right) were soaked.

Photograph by H. F. Loomis

LITTLE TOBAGO IS UNSPOILED AND IDYLLIC

How many millions of children in reading Robinson Crusoe have imagined a scene like this among the coconut palms! Yet the island's days of isolation seem now to be numbered. Air travelers can leave at sunrise on Wednesday from Trinidad, across the way, and be in New York in time for breakfast on Friday.

with 1,000 guineas, but before long it became evident that one factor had been overlooked, the factor of taste. The African blacks did not like the breadfruit so well as they liked bread; to them it was no better than their plantain. The effects upon the flour imports were nil, and the planters were disillusioned.

Although the immediate effects were disappointing, the thousands of breadfruit trees which now are scattered throughout the islands attest the growth of the taste for the fruit among the inhabitants.

THE GRENADINES ARE STORY-BOOK ISLANDS

The tiny islands of the Grenadines are fascinating; like little fragments of the world, they stand apart, completely left behind by the passage of events.

I recall on Bequia the little group of black school children who followed us across the trail to the valley of Friendship late one afternoon, eager to catch lizards for us, prompt with information about the enormous fruited tamarind which grew on the hillsides. They were enthusiastic about the chief food they knew, the pigeon pea, which, when properly cooked, is as delicate and palatable as the lentil of Bible history. Everywhere the hillsides were planted with this shrubby legume, and its yellow flowers made the pathways bright with color.

Bequia has an area of about 10 square miles; Cannouan is about one third that size. When we landed among the surprised natives in the early morning, the schoolmaster joined us.

On the superb white beach I was surprised to find the bonavist bean, *Dolichos lablab,* growing in profusion in pure sand. It is a species which I have often grown in Florida and found delicious when used as a puree or in soups. Should a share of the attention bestowed on the ordinary garden pea be given to this bonavist bean, we might have a popular new vegetable.

The curse of these little Grenadines is the manchineel tree, which lines the beaches everywhere (see page 716).

Of the four islands of the Grenadines visited, Mayero remains in my memory as the most romantic. In an afternoon Loomis and I went all over it, and as a result we have growing in our gardens a lot of little plumeria plants from the wind-swept eastern side of the island, a pretty new ficus from the summit, and a single tiny seedling of a handsome calliandra bush whose deep crimson flowers took my fancy.

Photograph by H. F. Loomis

CLIMBERS, BEWARE THE CARESS OF THE "PORCUPINE TREE!"

After once brushing against it and having its black, needle-sharp spines break off and fester in the flesh, one learns caution. The points which protect these young Acrocomia palms are shed as the trees grow older. There were once forests of them on Antigua, but now only a few stately specimens remain.

Carriacou, the largest of the Grenadines, has roads and a small botanic garden. We saw a fine stand of mahogany, the result of reforestation to conserve the rainfall.

On the hill above the town, where we went searching for leguminous plants, we found a new shade tree and a promising new ficus tree used as a windbreak.

One of the oldest botanic gardens in the West Indies is in Grenada. Thanks to the

Photograph by Capt. Albert W. Stevens

THIS DESOLATE LAKE HELPS TO PAVE THE WORLD'S CITIES

When Sir Walter Raleigh calked his ships with ooze from "ye Great Pitche Lake on Trinidad," he little suspected that out of it would come thousands of miles of asphalt highways for rubber-tired cars. From the air it looks like a big mud puddle. A man can walk across the semisolid surface, patched and veined with muddy water.

love for plants of almost all its British governors, it is still kept up and attracts many tree lovers.

In the nineties I had traveled with my old friend, Barbour Lathrop, out to the Spice Islands, where I saw the nutmeg in its native home, and heard how the Dutch resisted the taking of this tree to Grenada and other tropical islands. Therefore I was particularly interested in seeing the plantations in Grenada, where the nutmeg tree was introduced from Banda, in the Banda Sea.

On one of the old plantations some of the trees are nearly a century old. Of all the fruit cultures I know, that of the nutmeg is the neatest and most orderly. There is something unreal in the exquisite golden-yellow, pear-shaped fruit, which when ripe opens and shows the chocolate-colored nut covered with its scarlet network, the mace of commerce, itself an important spice. The fruits always seem to open in just the same way, to be of nearly uniform size and color, and to nestle among leaves as polished as those of the European holly.

When I walked under the trees in one orchard I was aware of the same dense shade and moist atmosphere and the strange glamour that I had felt in the Spice Island plantations of the East.

HOUSEWIVES DEMAND ROUND NUTMEGS

As nutmeg growing was profitable for the Dutch in Banda, so it seems to have been for the British planters of Grenada. Since 1865 the nutmegs of Grenada have come into the market in increasing quantities and,

roughly, a third as many come now from this island as from Banda.

Grenada nutmeg growers are bothered because their trees produce too many oblong nuts. Even if a long one is just as easy to grate and has practically the same aroma as a round one, century-old tradition demands the spherical shape.

Approximately 6,000 tons a year is the average consumption by occidentals of this remarkable spice, of which nobody wants more than a few small particles at a time. The welfare of two of the most beautiful little islands in the world, one in the Eastern and one in the Western Hemisphere, is tied up with man's taste for this nut.

When we arrived in the early morning at Port-of-Spain, Trinidad, we were aware of a marked change. Subtle differences in the water and the sky tell the initiated that he is nearing the continental Tropics, which in climate and other aspects are very unlike the small oceanic islands. Trinidad lies just off the delta of the mighty Orinoco, and its flora and fauna are those of South America.

There were wonderful mornings in the botanic garden, in charge of Mr. R. O. Williams, where we were joined by the former director, Mr. W. E. Broadway, who has watched grow from seed many of the finest specimens in this gallery of Nature's masterpieces.

In this garden is one of the finest collections of palms in the Western Hemisphere, but they form only one chapter in a complete book of strange, fascinating plants. The camoensia, with its magnificent gold-edged flowers of purest white, was in bloom near the Governor's residence. A tree of portlandia, with immense white blossoms, stood near the entrance. A new and brilliant-red perennial, *Scutellaria ventenati,* filled one of the borders, and the ground under a magnificent spreading forest tree was covered with flowers shaped like mouse-traps, belonging to that most remarkable of the families of trees which inhabit the tropical forests of America, the Lecythidaceae.

THE HOME OF AN ORCHID HUNTER

Mrs. Fitt, a daughter of my old friend, Eugène André, the orchid hunter, invited us to call, and as we drove into their place I was struck by the fact that we were passing under a pergola completely covered with a single hybrid orchid, *Vanda teres* X *V. hookeriana.* Miss Joaquim. It had grown so dense that it made almost a tunnel of the pergola. When it is in bloom, in the late spring, I am assured that it is one of the wonders of Port-of-Spain.

When Mrs. Fitt told me that she had an avenue of sealing-wax palms, *Cyrtostachys renda,* in her commercial nursery, and that they were in fruit, we went at once to see them, for this is one of the most aristocratic of palms, and I had been trying for years to introduce it into the United States. It is striking at all times, because of the brilliant red of its leaf sheaths, but when to this are added delicate pink fruit clusters and deep blue-black fruits, its beauty is amazing. It thrills me to see the hundreds of tiny seedlings coming up in our gardens from the seeds Mrs. Fitt gave me.

"WASHED ASHORE" ON A CRUSOE ISLAND

We passed three unforgettable days at Man-of-War Bay, on the north coast of Tobago, an island which is said to have furnished Defoe with some of the tropic setting for his tale of Robinson Crusoe (see page 707); this he combined with incidents suggested by the experiences of Alexander Selkirk, marooned on Juan Fernández Island, off the coast of Chile.*

The scene was so friendly as we sailed into that superb harbor, the golden sunshine lighting up the coconut palms and the flame-colored erythrinas, and bringing into high relief the moving fishermen on the beach, that nothing could stop the whole scientific contingent from piling pell-mell into the boat which Mr. Armour had especially built for landing on shelving beaches. We quite forgot his instructions not to overload it. Though we saw the great quiet rollers, we failed to be disturbed by them until we came close to the shore.

We were just thinking that one oarsman was not enough to land a boat with seven people on such a shore when the next wave gently raised the stern and tipped us all out into the surf. Sea sand in our hair and eyes, and drenched with salt water, we scrambled ashore after the manner of Crusoe himself.

We made plans to have a large surfboat meet the launch next morning; but the arrangement missed fire, and the fellows who came off were some inexperienced boys who

* See "A Voyage to the Island Home of Robinson Crusoe," by Waldo L. Schmitt, in the National Geographic Magazine for September, 1928.

Photograph by P. H. Dorsett

VAST SAVANNAS RECALL THE FLORIDA EVERGLADES

Here in the Guianas, however, the swamps are filled with ferns instead of "saw grass," and the water which soaks the muck is not alkaline, but as acid as that of a blueberry bog. The author holds a 10-foot Mauritia palm leaf (see illustration, page 714).

Photograph by H. F. Loomis

BUSH NEGROES PREPARING FOR A DANCE

These girls and women are descendants of slaves who revolted about 1762 and escaped into the jungle of Surinam to live their own simple, unsophisticated lives. Well-built houses, neatly swept streets, and characteristic, carved utensils indicate a high degree of community discipline (page 732).

knew no more about surf riding than we did, and Loomis and I got another ducking. The boys got a calling down from the older men, and we passed the day in wet clothes. But what a day!

COLLECTING ORCHIDS FROM A LAUNCH

Edgerly, the native guide, led us a hard scramble up the slippery slopes of Pigeon Peak. We sought the Astrocaryum palm, which is native there. It is lovely and slender-stemmed, but has vicious spines all up and down its trunk. To get their seeds we had to cut down the palms, and one of the trunks, falling across the steep, slippery pathway, hemmed me in against the hillside. The only way out was over its brittle spines, which seemed waiting to break off in me if I stumbled. I realized how quickly a danger may arise in the jungle. Alas, the seeds we collected that day have not grown!

Photograph by P. H. Dorsett

THIS AIR PLANT DIED ON ITS WAY FROM TOBAGO

Its flowers of green, blue, and vermilion were as fascinating as Chinese jade and lacquer; but, though Nancy Bell Fairchild helped pull it from a tree high up in the forest and carried it down the mountain side on her head, it did not survive the journey to the United States. Some one else must get it for the oak trees of south Florida.

We could see from the boat that the rocky cliffs of the harbor were covered with the Virgin orchid, *Diacrium bicornutum*, and from the way the surf was dashing against the rocks it seemed probable that this beautiful white orchid was bathed in salt mist all the time. I had never seen orchids so near the surf before, and since it was a rather rare species in cultivation in America, Mr. Armour and I decided to try collecting a quantity from the launch.

The sailors in their bathing suits did the work, while we stood off in the launch and kept clear of the rocks upon which the huge rollers would have smashed us if anything had gone wrong with the motor. It was a hot day and the sun burned us through our thin pajamas.

Reluctantly we dragged ourselves away from this idyllic island, and in two days were plowing through the muddy waters of the swiftly flowing Demerara River and anchoring off the old town of Georgetown, British Guiana.

It is perhaps incomprehensible that in 1667 the Netherlands should have given what is now New York in exchange for a patch of South America's coast. The price of sugar had much to do with this transaction; also the fact that slaves could easily

Photograph by Dr. David Fairchild

ONE OF THE STRANGEST FORMS OF PLANT LIFE ON OUR PLANET

The almost incredible coco-de-mer palm, here growing in the botanic garden of Georgetown, British Guiana, bears eight large fruits, each weighing 40 pounds or more. Three of them rest on the ground. They take 10 years to ripen. For centuries the huge black seeds, called "double coconuts," drifted ashore in the Orient and remained a deep mystery, until discovery of the Seychelle Islands disclosed their source. From there the seed from which this specimen grew was brought.

be brought over from West Africa to work the cane.

Mankind's craving for sugar has made many changes in the world. The Canary Islands were almost ruined when Demerara and the West Indies took to growing sugar cane, which was introduced to America by Columbus on his second voyage. Now the overgrowth of cane areas here and in the Orient, and the extension of the sugar-beet fields of Europe and America, have created an overproduction of sugar and consequent difficulties in the countries of the Caribbean.

In the botanic garden of Georgetown long canals were covered with that marvelous Amazon waterlily, the royal waterlily, *Victoria regia*.

A 40-POUND NUT TAKES 10 YEARS TO RIPEN

More interesting than the canals, or even than the large pond full of manatees, those strange mammals of the sea, were two rare palms seldom seen in botanic gardens anywhere: the beautiful stemless nipa palm of the Orient, which graced the borders of the pond, and which some day I trust can be grown in the southern tip of Florida, and a fine specimen of the double coconut, or coco-de-mer, brought from the Seychelle Islands about 20 years ago.

The coco-de-mer is one of the rarest palms in cultivation, and it is one of the most curious plants of this planet. It bears the largest nut known, and this nut takes ten years to ripen. Although I had read and heard much about the plant, I was astonished at its strange appearance (see opposite page).

Mr. Sydney Dash, the Director of Agriculture, kindly insisted that we make an attempt to transplant a small coco-de-mer to Florida, but the attempt was not a success. However, one of the nuts which he also gave us has surprised us, after a year of suspense, by sending up its strange-looking shoot.

Back of Georgetown there stretched away to the Amazon Valley some of the greatest savannas of the world—vast level plains, like the Everglades of Florida, covered with rank-growing sedges, grasses, ferns, and palms which, in the rainy season, stand several inches deep in water.

Mr. R. R. Follett-Smith, the soil chemist of the Demerara Department of Agriculture, offered to take us out there, and we found ourselves one morning speeding along the seawall, headed east.

A seawall 30 miles long and 10 feet high is just what one would expect pioneers from the Netherlands to build when they found the soils of the delta were richer than those of the highlands and far more accessible. In the swamps inside the wall hundreds of cattle waded in water up to their bellies, browsing on the marsh grasses which grew luxuriantly all about them. They seemed to be none the worse for their continual contact with the mud.

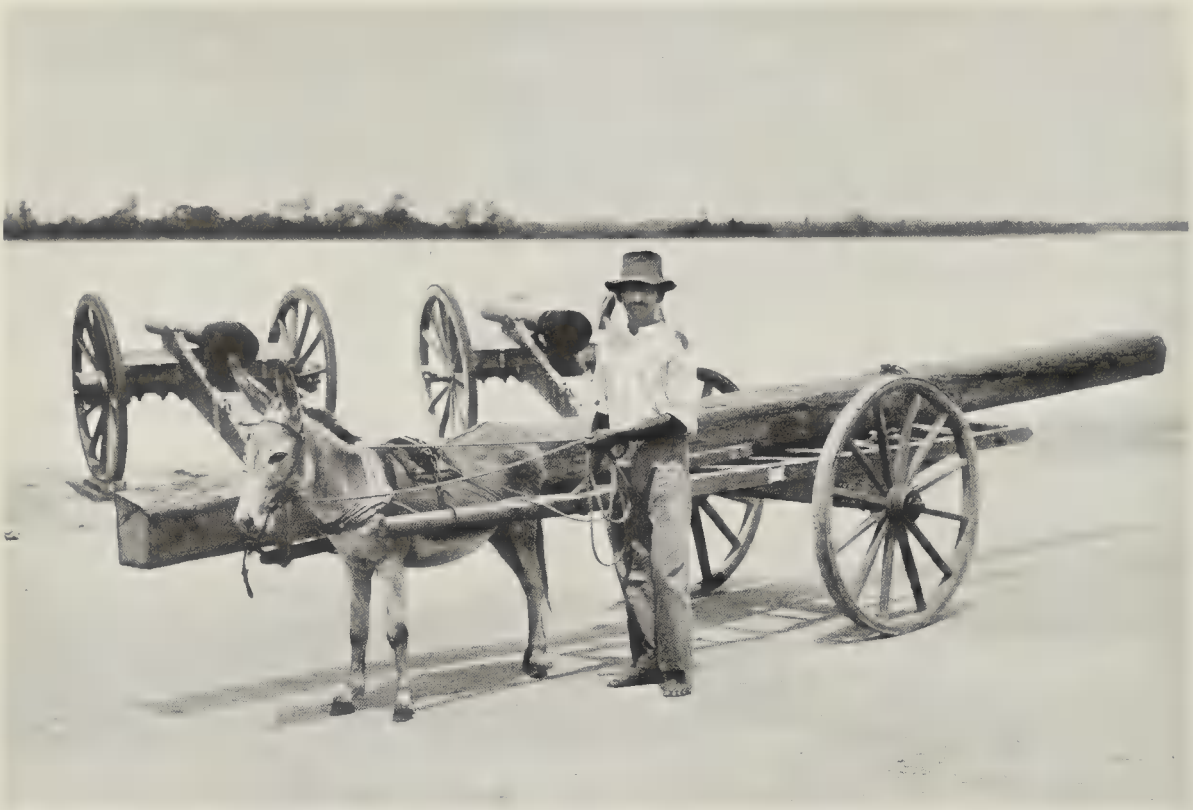
Photograph by Jacob Gayer

A TOUCH OF THE ORIENT GRACES PARAMARIBO

This East Indian woman, wearing nose button and bracelets of hand-chiseled silver, is one of many transplanted to Surinam, where their industry and frugality have given them a strong foothold. Vegetarians, they like long, slender snap beans, white navy beans, tomatoes, and the starchy sweet potato.

We left the highways and took to the native *corails,* or canoes, paddling through fascinating canals overgrown with vegetation, to a point where two of the long canals met and we could see off across the savanna.

About a mile up one of these canals we came to the first patch of Mauritia palms, vast forests of which stretch away through the lowlands of Demerara to the Amazon River. From a distance they suggest our Florida cabbage palms, but when one stands under them they appear immensely larger and more majestic, rising sometimes 100 feet, with huge fan leaves and perfectly amazing clusters of polished brown fruits.



A SINGLE GREENHEART TIMBER IS ALL A DONKEY CAN PULL

Dense, durable, and so heavy it will not float, this tropic wood is used mainly in wharf and ship construction. Fortunately for the diminutive draft animal, Paramaribo is flat and the hewn log rides smoothly on wheels that look as if they might be from a gun carriage.

Photographs by Jacob Gayer

PARAMARIBO ALWAYS LOOKS SPICK AND SPAN

Well-kept, tidy streets and simple, substantial architecture indicate that there is some measure of control over building operations as well as street maintenance in the city. Bicyclists and pedestrians pass sedately at leisurely pace.

MAN PITS HIS STRENGTH AND SKILL AGAINST THE RAPIDS OF THE SURINAM RIVER

These Bush Negroes took the author to the home of the wild pineapple (see text, page 732). While the boatmen turned their dugout around, the passengers waited on some slippery rocks in midstream. There Dr. Fairchild found a curious fresh-water snail apparently never described before.

Photographs by P. H. Dorsett

THE SPECIAL TRAIN'S "DINER" HEARTENED HUNGRY PLANT HUNTERS

They sped through the wild interior of Surinam, a region penetrated only by this narrow-gauge railroad and by rivers with dangerous rapids (see text, page 731, and illustration, above). The veteran naturalist, Dr. G. Stahel (fifth from left), interpreted the moving panorama.

Photograph by P. H. Dorsett

GUESS THE AGE OF THESE GIANT SHADE TREES

If they were oaks in New England, they might be a century old or more; but, being a quick-growing species in rainy, tropical Surinam, they probably have lived about three decades. They thrive in the Testing Garden (see text, opposite page) despite the somewhat oppressive-sounding name of *Enterolobium cyclocarpum*.

It took three men to carry one cluster, which after much effort they had succeeded in chopping off, and then the fruits dragged on the ground (see page 714).

Georgetown has an interesting little museum in charge of Dr. Walter E. Roth, who knows, as few can ever know, those shy races of aborigines which are scattered from the coast to the Amazon.

BAMBOO BLOWGUNS FOR POISONED ARROWS

We found Dr. Roth putting away with extreme precaution some poisoned arrow points which the Macusis use in their blowguns. The points had been dipped in the juice of the native strychnine fruit and were dangerous to handle.

"What are the blowguns made of?" I asked.

"Of a bamboo with joints 15 feet long," he replied, and quoted Von Schomburgk as authority.

I turned to the book and learned that in the back country of Demerara there grows the *Arundinaria schomburgkii*, having hollow stems without a joint for 15 feet I once found a bamboo in Sumatra with joints five feet apart, which I thought were the farthest apart of any in existence. Some day I am going back to South America for Von Schomburgk's bamboo.

We pushed on from Demerara to the lightship that marks the mouth of the Surinam River, and on up until we anchored just off the Governor's residence, in the spick-and-span town of Paramaribo. On its clean streets and sandy, calcareous soil, the whole life seemed to be slowly but carefully regulated with Dutch precision and orderliness. Even walking on the grass in front of the Governor's residence is cause for arrest, as Loomis discovered when he tried to back off on the lawn to photograph a palm.

The Governor, Dr. A. A. L. Rutgers, was a botanist and had previously been the Director of Agriculture in Buitenzorg, Java, and he appreciated the aims of the expedition. When Mrs. Rutgers, who also had lived many years in Java, learned that several of the party had been there, too, she arranged an old-fashioned "rice table" with all the accessories, prepared by a Javanese cook from the Javanese village (page 732).

Dr. G. Stahel, in charge of the Testing Garden, is thoroughly versed in the botanical problems of the Tropics. One of his first remarks was, "Now, Dr. Fairchild, you shall be the first American to see the flagellates I have found, which kill the Liberian coffee trees in this colony. I have been waiting for some one to come and see them."

This is the first time it has been proved that a tree disease is caused by these microscopic parasites. Through Dr. Stahel's microscope we watched the flagellates with their wiggling tails as they swam about in the sieve tubes in the inner bark of his sick coffee tree. Flagellates cause many animal and human diseases, and whether some of the other obscure plant diseases which have puzzled pathologists may not be due to similar microscopic animals is a question. Dr. Stahel suspects they are.

Photograph by Jacob Gayer

THIS NURSEMAID HAS DINNER ON HER MIND

To anyone who has never seen pots and saucepans borne on the head, the feat may seem a cause for some wonder as well as amusement, but it is an everyday sight in Paramaribo. In some West Indian islands such work is reserved for women, and a man would be as ashamed to carry a load in this way as some men in Europe are to be seen with a parcel

In a chartered train on a narrow-gauge railroad we went to see the vast hinterland and the Bush Negroes. These essentially wild men, descendants of West African slaves who escaped from slavery about 1762, soon after their arrival in the Guianas, have scarcely been touched by our civilization.

We stopped to visit a typical Carib Indian village, the first I had ever seen. The native Indians are a rather unresponsive people whose way of life is far removed from our encroaching civilization and they will not change. After all, why should they? They have a right to like their way better.

At Kabel we left our train and climbed into large, carefully built dugouts, which were manned by Bush Negroes. The men were splendid-looking specimens; their brown bodies glistened in the sunlight, and they laughed and chattered as they handled the long paddles. The Surinam is wide and swift at Kabel, and full of rapids which require great skill to negotiate.

The waters are infested with perai, those small voracious fish which hunt in schools and attack and tear to pieces any living, warm-blooded creature, so that one does not casually cool one's body by a dip in the river. Dr. Stahel even warned us against trailing our hands in the deep water, for fear the fish might nip our fingers.

Photograph by H. F. Loomis

AHEAD OF THE "UTOWANA" RISES "NAPOLEON'S COCKED HAT"

To approach the fascinating crater island of Saba at dawn, to see it come up out of the sea more than 2,000 feet into the air, and to know landing is impossible unless the wind is in the right direction—this is the maddening experience of many who have to pass it by.

Under the overhanging branches of trees, covered with masses of creepers, we glided downstream to Kadjoe. Several dugouts, made of the carapa tree, indicated the harbor of the village, where a Negress was bathing, safe from the predatory fish, in the shallow water near the shore. It was sultry and the sun was burning hot, but as we stepped into the mud-beaten paths under the forest trees it was cool and pleasant.

I was struck by the orderliness and neatness of the village. The little low houses, copies, I think, of the huts of their ancestors in the African bush, were carefully built, with a true sense of proportion, and often they had interesting carvings about the doorways. The stools, trays, and drums also showed distinctive carvings (see illustration, page 724).

Dr. Stahel and I were paddled farther down the river, where we stepped off the rocks into the jungle, and he showed me the pineapple in its original wild home. I collected it for the plant breeders, who want it to make the cultivated pineapple more vigorous and more resistant to disease.

A PATCH OF JAVA IN SURINAM

For years the Dutch planters have been bringing over Javanese coolies to work their fields, until now there are about 30,000 in the colony. Dr. Stahel took me out to Lelydorp to see one of their largest villages. The houses were strange, faint reproductions of the charming bamboo cottages of Java, for the walls were made of crooked staves instead of the beautiful "billik" that is so generally used in Java for the walls of houses—a coarse, woven matting made of thin strips of bamboo. The pattern of a Javanese house seems to be just as fixed as the nest of an oriole. Lacking the materials with which he is accustomed to build it, the Javanese does what any oriole would do—he uses substitutes.

I looked about for Javanese plants and was surprised to find that so few had been introduced in 30 years by these immigrants. A few tali bamboos were there, from which the house walls are made in Java; a single durian tree; the famous mangosteen; and the rambutan. The betel vine, used by betel-chewing habitues, had been set out in plantation form.

The jackfruit, too, had been planted, and when I seemed delighted to see the fruit once more—for it is comparatively rare in the West Indies—its owner climbed the tree and cut one off for me. As I looked to see what he was doing, the huge fruit fell with a crash and spilled its yellow contents over several square yards of ground, to the consternation of the other Javanese standing by, who rushed forward to save the fragments.

He cut another and lowered it carefully, and we had it on the yacht, where Ernest made a delicious compote from its fleshy arils before it got too ripe and began to attract the tart comment of Dorsett whenever he passed it on the after hatch. When it is overripe, it has some of the wealth of aroma of the durian.

Photograph by Bransby from Galloway

HERE YOU CLIMB UP 900 FEET TO REACH BOTTOM

It's not so impossible as it sounds, for Bottom is a village in the crater of Saba, a steep-sided extinct volcano (see text, below, and illustrations, pages 734 and 735). Baggage and freight are borne up such steps as these on the heads of Negroes whose lung power amazes panting visitors.

At Martinique we were busy with a collection of yams and dasheens. We saw some superior sorts being grown for the peasants by the agricultural experts at Tivoli and Mr. Dervegeant kindly offered us some.

I use the word "peasant" advisedly, for it was my impression, as we drove through the island and talked to the farmers, that there was something curiously reminiscent of the French peasant in the independent attitude of the natives of Martinique. They seemed better able to care for themselves than some natives of other islands, who had learned little except to work in the cane fields.

The island of Guadeloupe still showed plainly the destruction which the last hurricane had wrought, and the stories of death and disaster were still on people's lips. We visited it to find which trees had withstood the terrific winds, so that we might try them in our own hurricane area.

A VILLAGE IN AN EXTINCT CRATER

I find it hard to write of Saba without exaggeration, so vividly does the day we spent there stand out in my mind. The memories of it are as haunting as those that both Capri and the little isle of Banda, in the Banda Sea, brought into my life years ago. I have memories of charming Dutch children with soft voices and friendly ways, of sturdy fishermen and boatloads of fish, of cottages perched like swallows' nests far up on the hillside, of a simple village life

Photograph by H. F. Loomis

HIS MAJESTY'S SHIP "DIAMOND ROCK" STANDS OFF THE MARTINIQUE COAST

In recognition of the daring of British naval officers and men who hauled big guns up its sides and defended it against the French in 1803, the rocky island was officially listed by the Admiralty as one of Britain's men-o'-war. It is now a French possession.

Photograph by Ewing Galloway

AT SABA THE SEA IS EVER READY TO SMASH AND KILL

One who has not been in a small boat and felt the force of a mighty roller sweeping the craft toward the rocks can hardly appreciate the excitement of this scene. Even the island's experienced fishermen are tense and vigilant, for they know the dangerous power of the waves that dash on their boulder-covered beach.

Photograph by Dr. David Fairchild

IN PRETTY COTTAGES ON SABA OLD SAILORS FIND "SNUG HARBOR"

After fighting the storms of the North Atlantic, many a mariner returns to pass his last years here, at lofty Windward Side, or at one of the little Dutch island's other two towns. The young woman in the foreground said she kept in touch with the outside world with the aid of the NATIONAL GEOGRAPHIC MAGAZINE (see text, page 736). At the left are cacao trees, from the seeds of which chocolate is made.

in which there are no strangers, and of a shut-in valley of terraced gardens across which you hear the voices of the people.

No large vessel can land at Saba, for there is only a tiny beach between great boulders (see opposite page).

The little island is an extinct volcano, and one of its three villages is literally the bottom of the crater, although 900 feet above the sea.

Five square miles of land, most of it as steep as the gable roof of a house; 1,600 people, mostly of Dutch descent; a history that runs back about as far as that of New England; and a genealogy of hardy, seafaring folk, like that of the old inhabitants of Martha's Vineyard—that is Saba.

Although some of the inhabitants are black, and a mutual tolerance exists, there are few evidences of marriages between the races.

As the volcanic cone came into sight and we drew near enough to assure the watchers on shore we intended to land, we could see the children running like goats down the "Ladder" that leads from the village to the water. There are two landings, and when they saw we were headed for the other one, they ran back, came down the stairway, and met us halfway up the hill to Bottom.

Photograph by Ella Barnett

OLD AND NEW MEET AND PASS

When Lafcadio Hearn was writing his poetic stories of Martinique, only oxcarts creaked their slow way across its mountain roads. Now between Fort-de-France and the new city of St. Pierre, which has arisen on the ashes of the volcano-buried town he loved, vehicles that would amaze him roll swiftly along the trails.

Those rosy-cheeked, enthusiastic children were girls and boys of Dutch descent, but they spoke perfect English. From their reception one would have imagined we were relatives coming home from the Netherlands. With laughing chatter they conducted us, panting and dripping, to pay our respects to the Administrator.

We had not expected to find much for our collections in Saba, and we didn't. We botanized over the hillsides on the roughly made terraces, where pumpkins, sweet potatoes of rather poor quality, and the bonavist beans were grown, the last mentioned, to my surprise, forming an important part of the diet (see text, page 721).

THE GEOGRAPHIC IDENTIFIED HIM!

As Miss Butler, of Windward Side, was showing me the tanks back of her father's house in which the season's supply of rain water was caught, she suddenly looked at me and inquired, "I think I have seen your name on the inside cover of the NATIONAL GEOGRAPHIC MAGAZINE, haven't I?"

Bang went the illusion of isolation! We were right around the corner from Sixteenth and M Streets, in Washington, D. C. I photographed Miss Butler and determined to tell the staff of THE GEOGRAPHIC that again I had failed to find a spot where THE GEOGRAPHIC was not known.

Mr. Armour, with Mrs. Fairchild, returned to the yacht early and gave the residents a tea party. Nothing compared in novelty, so far as the children were concerned, with the ice water.

This tiny but highly intelligent community is one of the few white groups in the West Indies, and, although isolated beyond almost any I have visited, keeps in touch with affairs of the outside world.

By this time the shadow of the approaching end of the expedition began to affect me and kept me pretty constantly at my desk, where my job was to determine the botanical relationships of the plant material we had all collected, and of the new accessions constantly brought in by Dorsett, Loomis, and L. R. Toy, three assiduous collectors of anything that looked promising for cultivation in the United States.

Barbuda, with only two white people among 1,000 blacks; Anguilla, where we

Photograph by H. F. Loomis

BEHIND THE SCENES ON THE PLANT-HUNTING YACHT "UTOWANA"

In pajamas, Howard Dorsett and the author (left) gloat over the prizes of a hard day's foraging on verdant St. Lucia. All specimens must be identified and examined for insect or fungus pests. Some will be dried and others planted in small greenhouses aboard. Fast work is essential, for to-morrow a new island may come into view.

hoped to find wild cotton but didn't; little St. Martin, seven miles long, half Dutch and half French; and beautiful Tortola—all added their quota to our treasure store.

We had our last day's collecting on the strange little island of Mariguana, where, in the cool spring rain, we wandered about through the typical Bahaman brush until our clothes were torn and tattered, in a vain effort to add a last specimen of value to our collection.

Best of all were the thrills that came to me day after day at my little table under a double porthole, through which the morning sunlight would come and go with the shifting of the ship, as I studied the constant stream of new and strange plant forms whose flowers, leaves, and seeds peered up at me through my hand lens and microscope. Each had its particular appeal. Each required a decision regarding its name, its use, its chances of living in America, what to do with it when it was introduced, and how best to prepare it, pack it, and ship it by air express or by boat.

How many hundreds of species we passed judgment on I do not know, but we decided to take the chance of introducing 700 of them.

PLANTS FOR GARDENS, STREETS, ORCHARDS, AND MEADOWS

Shade and street trees, windbreak trees and hedge plants, garden vegetables and border flowers, pergola vines and ornamental shrubs, fruit trees and forage plants—these make up the chief categories of the 700 species and varieties collected, not to mention the rather extensive collection of palms and the bags of cotton seeds which formed a particular part of our quest.

It is too soon to tell what fate awaits the seeds and plants we gathered. That some have already died we know, and we predict that others will fall by the way, but we believe that there will be a goodly number of successes, as there have always been from other expeditions.

Perhaps, years hence, those of us who took part in the expedition may be reminded by some of them of a thrilling winter spent in the Caribbean hunting plants.

THE SOCIETY'S NEW CARIBBEAN MAP

Mexico, Central America, and the West Indies—Gateway of Discovery

THE Caribbean region, glamorous gateway through which exploration first penetrated the Western Hemisphere, is shown in clear and up-to-date detail on the National Geographic Society's new map of Mexico, Central America, and the West Indies.

The map, in ten colors, reaches members as a special supplement with this issue of The Magazine.

Here Columbus discovered America—some islands and parts of the coast from Honduras to the mouths of the Orinoco. Within the compass of the map is shown far more than the Admiral ever saw of the New World. He believed himself off the coast of Asia. Bewildered, he probably would have traded half his mutinous crew for a little of the geographic knowledge contained in this modern chart.

LURE OF GOLD—SPANISH MAIN!

Here began the search for Indian gold which lured Balboa to the discovery of the Pacific Ocean, Cortez to the conquest of Mexico, De Soto to the finding of the Mississippi—and to a grave in its depths.

On the Central and South American mainland was the storied "Spanish Main." Cities sprang up and vessels laden with treasure cast off for Cádiz. Piracy and privateering flourished. Swift English, Dutch, and French raiders preyed on Spain's slow, clumsy bullion ships. The Spaniards quaked at the bloody exploits of Morgan and Blackbeard, who lurked like ravenous barracudas amid the islands.*

To-day this region is split into eager young republics seeking to make the most of their heritage of natural resources. Ships ply the surrounding waters laden not so much with gold and silver as with petroleum, sugar, coffee, and bananas.

The United States Navy, guarding the Panama Canal from strategically located bases, controls, in the interest of peace, the shipping lanes where buccaneers once lay in wait—the Straits of Florida, the Windward Passage, between Cuba and Haiti; the Mona Passage, between Puerto Rico and the Dominican Republic, and the Anegada Passage, east of the Virgin Islands, shortest route from Europe to the Canal.

Between North and South America fly huge passenger planes.

An eloquent red line on the map marks the route of the Inter-American Highway. From Nuevo Laredo, on the Rio Grande, it winds down through Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama. The part constructed up to January, 1934, is shown by a solid line and the unfinished portion by a broken line, as far as Panamá City. From there it will be carried on eventually to South America, thus uniting the two continents and all the countries between by road.

The dense jungles of the American Tropics are among the hardest places to map, but the cartographers of the National Geographic Society have depicted them in greater detail than ever before on this scale. Special insets give "close-ups" of Puerto Rico, the Virgin Islands, Bermuda Islands, Isthmus of Panama, Jamaica, and Cuba.

MAP ACCURATE TRAVEL GUIDE

Like The Society's previous Caribbean map, which was highly praised by aërial navigators, this one is so planned and drawn that, in spite of the impossibility of exactly portraying part of a globular earth on a flat sheet of paper, all areas appear in their true form and direction from each other. A navigator by air or water may lay down a course on this map, fly or sail along it, and be sure of coming to his desired destination.

On the inset map of the Isthmus is plainly shown the latest engineering miracle in connection with the Panama Canal—a brand-new man-made lake, the Madden Reservoir, created by a dam 950 feet long. It will control the waters of the Chágres River, which in the rainy season becomes a turbulent stream and causes a troublesome current across the Canal lane. The water impounded also will provide a reserve for release into the Canal in the event of a water shortage. A third function of the $15,500,000 project, now nearly completed, is the production of hydroelectric power.

* See "The Haunts of the Caribbean Corsairs," in the NATIONAL GEOGRAPHIC MAGAZINE for February, 1922.

Photograph by John Oliver La Gorce

STEAMERS AND NATIVE BUMBOATS NOW, INSTEAD OF PIRATE BARKS

Typical of the romantic and languorous West Indies is this giant Bahama Negro, an ebony poem of motion as he sculls his merchandise-laden craft from wharf to yacht over the limpid waters of Nassau Harbor.

The inset of the Bermuda Islands is of special interest because of the scientific achievements of Dr. William Beebe and Otis Barton in Bermuda waters last summer, under the sponsorship of your Society. Easily located is Nonsuch Island, off which the divers descended in their Bathysphere to a depth of 3,028 feet (see page 661).

On the map appear exactly 5,460 place names. A departure since the previous map is the use of foreign nomenclature for places in foreign lands. Thus, Nicaragua's Mosquito Coast is now the Costa de Mosquitos. Cuba's Isle of Pines is Isla de Pinos, and Havana is Habana. Tortuga Island, a favorite haunt of early buccaneers, becomes Isle de la Tortue because it belongs to French-speaking Haiti.

An ancient name is officially revived and the island of Haiti is Haiti no longer, but Hispaniola, a Latinized form of the name La Isla Española, bestowed upon it by Columbus in 1492. Thus the old Indian title of Haiti, meaning "mountainous country," is reserved for the Negro Republic, occupying the western third of the island.

The map is made easy to read by the large scale of 1:5,702,400. One inch on the map represents 90 miles on the ground. Relief is shown by hachures, and altitude by figures printed at frequent intervals.

The political boundaries are indicated by harmonious coloring, so that they are instantly seen without the necessity of tracing an elusive line to ascertain whether a place is in Mexico or Texas, in Panama or

Costa Rica, if it happens to lie near the border.

For the sea-going geographer a dotted line indicates depths of 100 fathoms or less, while extreme depths also are shown.

Most profound of all, and incidentally the deepest spot in the entire Atlantic Ocean, is the Nares Deep, just north of Puerto Rico. The keel of a ship passing over it is much more than five miles above the ocean floor, for the latest official sounding there, as noted on the new map, is 27,972 feet.

Contrasting with the "deeps" of the ocean, we find a "high" in Colombia, where, almost on the seacoast itself, the Sierra Nevada de Santa Marta rises to 19,030 feet. Second place goes to Mexico's Citlaltepetl, "Star Mountain," 18,077 feet.

In the American Tropics, too, the Gulf Stream, warm water heating plant for much of the world, has its beginnings. Rebounding from the Central American coast, the current swings northward into the Gulf of Mexico and emerges from the Straits of Florida as a deep stream many miles wide.*

What may seem like geographical contradictions may be gleaned from a careful study of the map. For instance, ask someone whether the Panama Canal is east of Florida, and he will look at you with doubts until you show him on the map. A ship bound from the Atlantic to the Pacific is going *southeast* when it passes through the Canal, not west.

IF THESE PLACES COULD SPEAK!

One can hardly set a finger down anywhere on the map without touching some spot to which a stirring story is attached.

In the Republic of Haiti appears La Citadelle, famous stronghold of the black king, Christophe, of more than a century ago. Two little towns near by perpetuate the comic-opera names of two of his dusky noblemen, the Count of Limonade and the Duke of Marmelade.† On the south coast of Cuba, not far from San Juan Hill, of Rough-rider fame, is Daiquiri, tiny port where the first American soldiers landed in '98.

On the outer fringe of the Bahamas is San Salvador (Watling Island), generally regarded as the spot where Columbus first set foot in the New World on an October morning 442 years ago. He named it for the Savior and claimed it for his Spanish sovereigns, but it is now under the British flag. In fact, Columbus, looking over the map to-day, would search in vain for any vestige of Spanish sovereignty. The only European nations represented in the area are Great Britain, France, and the Netherlands.

In the Dominican Republic, on the island of Hispaniola, is one of the strangest and most fascinating areas in the Western Hemisphere—that around Lake Enriquillo. Several small streams empty into the lake, but it has no visible outlet. It has been falling slowly for many years and is now about 150 feet below sea level.

OCEAN HAS ENGULFED AN EMPIRE

In this Caribbean region as a whole, long chains and clusters of islands, like the half-drowned tops of mountains, bear witness that mighty natural forces have been at work. In the Bahamas a feat of scientific detective work by means of soundings has recently disclosed ancient river valleys on the ocean bottom at a depth of 15,000 feet. What was once dry land is now buried under nearly three miles of water!

Look over some of the names on the map. What an insight we get into the feelings of the early explorers by a name such as Cabo Gracias á Dios, which marked the southward turn after days of sailing along the Honduras coast. "Cape Thanks to God." Tradition says Columbus named it when he sailed down the coast on his final voyage.

The Caribbean Sea—it preserves the memory of the warlike and cannibalistic Caribs. The Mosquito Coast was the home of the Mosquito Indians. Nicaragua was the name of a doughty native chieftain. Costa Rica means "Rich Coast," and Venezuela is "Little Venice" because early explorers, finding the Indians living in huts on poles over the water, were reminded of Italy's ancient canal city. In Jamaica is Spanish Town, so called because the English sailors could not get their tongues around the Spanish name, Santiago de la Vega.

So it is that in reading THE GEOGRAPHIC, in studying history or current events, in planning a fishing trip, a flight to Jamaica, or the establishment of a branch of an export business, you may find your Society's new map a valuable source of reference and an aid to a better understanding of the countries to the south.

* See "The Grandest and Most Mighty Terrestrial Phenomenon," by John E. Pillsbury, in the NATIONAL GEOGRAPHIC MAGAZINE for August, 1912.

† See "Haitian Vignettes," by Capt. John H. Craige, in the NATIONAL GEOGRAPHIC MAGAZINE for October, 1934.

LORDLY MONTEZUMA STROLLED AMONG THESE AHUEHUETES

The age of these giant cypress trees only a tree-ring expert may judge, but they were not young when the proud Aztec monarch sought their shade. Birds and flowers abound in the tropical setting of this statuary-dotted woodland of Chapultepec Park, Mexico City.

Photographs from George F. Paul

A ROMANTIC RENDEZVOUS IS THE FOUNTAIN OF FROGS

Señors and señoritas of Mexico City linger for hours in this idyllic spot of Chapultepec Park, where queer heronlike birds have gazed at each other for years around the inside of its tiled wall, and a turtle tirelessly supports the central gusher.

Photograph by Edwin L. Wisherd

A HARD-FOUGHT POLO MATCH CEMENTS FRIENDSHIPS BETWEEN NATIONS

In September, 1934, Mexican and U. S. Army teams met at Potomac Park, Washington, in international contests witnessed by Government officials and other distinguished citizens. That they might quickly identify their mates, members of the team from the southern republic wore jerseys marked by broad horizontal bands of color. Their opponents wore vertical stripes. Shins of the horses have been bandaged to protect them from hard-hit balls and swinging mallets.

Compañía Mexicana Aërofoto

MEXICO'S "WHITE HOUSE" IS PILLOWED DEEP IN A BED OF AGE-OLD TREES

Chapultepec Castle, home of the President, was originally planned as a summer home for the Viceroy of Spain in 1783. In 1847 it was the scene of a desperate battle between Mexican and United States forces. Maximilian renovated it in the grand manner of an Italian villa. To the left of the lower end of the famous boulevard, Paseo de la Reforma (right), are buildings of the Department of Public Health. Across the left foreground spreads the Colonia Roma, exclusive residential district.

VICTORY BREAKS THE BONDS OF SERVITUDE

The Statue of the Independence, in Mexico City, is crowned by a winged figure holding in her left hand links of a broken chain, emblematic of her country's

Photographs from George F. Paul

A FOUNTAIN WEEPS FOR A BELOVED STATESMAN

Beyond the graceful jets of spray in delightful Alameda Park, Mexico City, is the hemicycle commemorating a humanitarian President of the Republic, Benito

Photograph by Fairchild Aërial Surveys

QUEEN ON A COMMERCIAL CHESSBOARD IS THE ANCIENT CATHEDRAL OF MEXICO CITY

Around the "St. Peter's of Mexico" swirls the busy life of the capital, many of its canyon streets leading into the cross-pathed Plaza de la Constitución. One of the first great Christian temples built in North America, it rises near the site of a pagan Aztec sanctuary. On the right of the square is the National Palace. In the right background is the Church of Santo Domingo, remnant of the one-time Monastery of the Dominican Order.

Photograph from George F. Paul

CHOLULA'S ARTIFICIAL MOUND RIVALS THE PYRAMIDS OF EGYPT

Raised by grateful natives in memory of the pagan god Quetzalcoatl, who, legend says, tutored them in the ways of life, this awe-inspiring pile is twice as long at its base as the great monument of Cheops. Tangled shrubs and wild verdure hide the truncated hill which to-day supports a glistening white church dedicated to Our Lady of Help

Photograph by Branson De Cou from Galloway

MEXICAN "GONDOLAS" CARRY TOURISTS ON HOLIDAYS, VEGETABLES ON WORKDAYS

The famous Canal de la Viga is a gay waterway for pleasure-bent thousands traveling between Mexico City and Xochimilco ("The Place Where Flowers Are"). Lilies choke the water in places, making harder the work of the boatman punting his flat-bottomed craft. Flowers wage a battle of color in early spring, and songbirds make music in the eucalyptus trees along the banks.

A CHARRO AND HIS HORSE AFFECT THE DANDY'S REGALIA

As he lavishly grooms his pony, so does the gentleman rider outfit himself in richly embroidered trappings. His fancy jacket, fringed trousers, and spurred heels are in keeping with the studded leather of his saddle.

Photographs by Hugo Brehme

MEXICO REMEMBERS THE "PROTECTOR GENERAL OF THE INDIANS"

The statue of Frey Bartolomé de las Casas commemorates the heroic priest who spent his life trying to shield New World natives from the oppressive rule of conquerors. The unit of the Cathedral (see page 745) is the Sagrario Metropolitano, with its striking east façade.

THE OFFICE OF THE PRESIDENT OF MEXICO OCCUPIES AN ENTIRE BLOCK

In the National Palace are also the offices of the Secretariats of War and Navy and the Treasury. Its rose-and-maroon lava stone front extends along the east side of historic Plaza de la Constitución.

Photographs by Hugo Brehme

A MODERN SKYSCRAPER CASTS ITS SHADOW OVER MEXICO CITY

Tallest in the capital is the "set-back" building, La Nacional, housing business offices. The foreground structures, which might be mistaken for subway entrances, are pergolas of flower venders, typical of the charming medley of old and new in the city.

Compañía Mexicana Aërofoto

MEXICO'S MAJESTIC "WOMAN IN WHITE" SLEEPS BESIDE A SEETHING FURNACE

Because its snow-covered summit rather closely resembles a recumbent female figure, volcanic Iztaccihuatl (foreground) bears a distinctive name. Beyond is its twin, Popocatepetl (see page 754), often called the Vesuvius of America, so violent are its outbursts of lava. Only four North American mountains are higher than "Popo." Cotton-puff clouds caress the time-weary slopes.

Photograph from George F. Paul

AN EXPERT HORSEWOMAN RECALLS GOLDEN DAYS OF MEXICO

One of the remaining few who ride with the skill of their forbears, she wears a bright-colored "china poblana" skirt—woolen, heavily bespangled, and gay in reds and greens. Her blouse is richly embroidered, and around her throat hang several strings of brilliant beads.

Photograph by Hugo Brehme

THE PEON'S HERO STOPS TO HEAR A HUMBLE PLEA

At Cuautla is the statue-crowned tomb of Emiliano Zapata, who led the march of a ragged army on Mexico City in 1910. The tempestuous political career of this cowboy-ranchman began with a vow to return the land to the peasants and ended by a bullet.

Photograph by Hugo Brehme

MEXICO WAS BUSY WITH WATER TOWERS WHEN THE PILGRIMS LANDED AT PLYMOUTH

The curiously telescoped pile and its twin across the ravine were erected in 1620 to store water from a neighboring gorge. A modern aqueduct spans the valley to-day, near Naucalpan. The village is noted for its enshrined Virgin of Help, patroness of Spaniards in Mexico. After a Mexican victory a general issued an order that the image be cast out of the country, but relented when the Spaniards promised never to use it to influence politics.

Photograph by Hugo Brehme

A FRENCHMAN WHO DIED A PAUPER BUILT A SPANISH COLONIAL CHURCH IN A MEXICAN TOWN

José de Laborde was once looked upon as the richest mine owner in the world, as a result of his search for gold and silver in the hills about this village of Tasco. Fortune frowned, but not until Europe had sent its best architects and Asia its rare objects of art to erect a memorial to his enduring fame. From the ore of Tasco Spaniards sent home their first shipment of silver. In the foreground are Mexican peons taking produce to market.

Photograph from George F. Paul

"POPO" PUSHES ITS SNOW-TIPPED SNOUT THROUGH A WREATH OF CLOUDS

Soldiers of Cortez, it is said, took excellent sulphur from the yawning lava pit of Popocatepetl to make gunpowder for their battles against Mexicans. Worshipers at the white church make their way thither past stately fir trees and through planted fields hemmed in by rows of maguey. From this plant is dipped the as-yet-unfermented juice that is made into pulque—pasty-white, quick-spoiling, and sour-tasting.

Photograph by Hugo Brehme

LIKE A PREHISTORIC MONSTER, THE AQUEDUCT CRAWLS ON A THOUSAND LEGS TO QUERÉTARO

There, in 1867, Maximilian faced a firing squad. Escutcheons dating from colonial days mark many doors of the city, famous for delicious fruits and berries. Water carriers fill their pottery jars at a central fountain fed by this many-bridged conduit, construction of which was completed in the 18th century. A statue has been raised to the Marqués de la Villa del Villar del Aguila, who contributed thousands of dollars to the undertaking.

Photographs by Ewing Galloway

THREE LITTLE MEXICANS PRESENT BOTH SIDES OF THE PICTURE

It is a fiesta day dedicated to the poor. Each chubby-cheeked youngster has dressed as an Indian peon, or laborer. The boys, with their indispensable serapes, carry tiny crates of pottery and live poultry, and an extra hat for sale. The girl, in wrap-around skirt and hand-woven sash, carries flowers.

TRAVELS WITH A DONKEY IN MEXICO

Three Adventurers Trudge from Oaxaca to Acapulco, 400 Miles, Through Back Country, Their Equipment Carried by Burros

By Bernard Bevan

With Illustrations from Photographs by the Author

NOT until one has wandered about Mexico can one appreciate how incomplete was the Spanish Conquest. Only isolated Spaniards and occasional marauding expeditions ever penetrated to southern Oaxaca and Guerrero. No wealthy monasteries, sure sign of Spanish infiltration, were ever founded here, and the grandiose churches so striking elsewhere in the Republic are conspicuously absent. Since the coming of the Spaniards this region has remained commercially, culturally, and artistically a backwater (see map, page 760).

There are in Mexico nearly 500 tribes and more than 200 languages, some differing from others as much as French from Chinese.

FOUR RACES IN 400 MILES

In the 400 miles between Oaxaca and Acapulco, Maureen Herbert, James Sturken, and I, put afoot when our bus "decomposed" at Mitla (see illustration, page 759), walked across four racial and linguistic frontiers—the Zapotec, Chatino, Mixtec, and Negro. At Tlacolula we were close to yet another tribe, the Mixe, distantly related to the Mayas of Yucatán. Even so, we have omitted the Amusgos (Amishgos), Tlapanecos, and isolated colonies of Aztecs, all of whom retain "islands" in Mixtec territory.

The physical characteristics of Mexico are as varied as the civilizations. Vegetation and scenery change with almost every league, the enormous variations in altitude enabling one to pass from subarctic to tropical climate in a single day. Sometimes within a few hours we saw eagles from the high mountains and parrots from the tropical jungle.

Our route is unlikely to attract tourists. There is no railway, no road, no hotel, no bed, no butter or fresh vegetables, and the discomfort has recently increased since the virtual destruction by earthquakes of nearly half the towns we passed.

The white man seldom travels in this region. He is not only excellent bait for the numerous bandits on wilder stretches of the road, but an object of suspicion among quite well-intentioned Indians, who imagine he is searching for gold. They have never forgotten the Spaniards' quest for treasure, and to say you are collecting beetles or studying architecture is to them absurd. They are victims, too, of even stranger traditions, notably that the white man desires to fatten Indians and boil them for lubricating oil, or to steal native babies for similar "reduction" as airplane fuel.

For many reasons we deemed it advisable to disguise ourselves and to travel as the poorest peon. We emerged from the market of Oaxaca in white and purple trousers, heavy leather sandals, and broad-brimmed straw hats. Over our shoulders, and chiefly for use at night, we carried large woolen Oaxaca blankets, or serapes—blue, white, and black. Our money we carried in stout leather belts, all of it in silver and copper coin, for bills are not accepted in villages where men cannot read their value.

Finally, we gathered machetes, a dagger, old flour sacks to contain food, and for water a glass *garrafón* neatly dressed in a straw jacket like a bottle of Chianti. All these "personal effects" we fitted into brilliantly colored string bags.

We set out for Tlacolula, the railhead, near Mitla, and there invested in two donkeys. Unfortunately, these proved too decrepit to carry both passengers and baggage—a fact we did not discover until we had footed the bill and hopefully baptized those pathetic animals "Pegasus" and "Pullman."

Chiefly for the donkeys' benefit, we engaged a donkey-driver, guide, or "porter." I doubt whether he had ever driven, directed, or counseled donkeys before, since

Photograph by Emma Reh

SOME MEXICAN POTTERY DESIGNS HAVE NOT CHANGED FOR CENTURIES

Like parts of China, Mexico is a land of handicraft industry. Here, at Ocotlán, the product is identical with that of Oaxaca, famous since time immemorial for its clay workers. Ceramic idols from the Spanish Conquest still mark ancient graves (see text, opposite page). There is not a village market without its display of the potters' wares.

by trade he was a sandal-maker; but he spoke Zapotec and rejoiced in a grandiloquent name, perhaps his chief claim to immortality. Under his auspices we loaded the donkeys with four tall cylindrical baskets for the baggage (see page 761).

SOME POMP ATTENDS THE START

As we dawdled out of the sleepy little town of Tlacolula, it was 4 o'clock in the afternoon, and afternoon was in the atmosphere. The market was deserted. Pigs and scraggy dogs of uncertain race and temper sprawled in the dust heaps. Only our grunting donkeys broke the stillness of siestatime.

Soon we were out in the plowed fields with the village behind us, a blue-green gem on the sunburnt plain. All around, the horizon was bounded by lofty turquoise mountains. Here and there on the lower slopes stood big white churches with red domes like toy rubber balls sliced in half. In the foreground were vast fields of maguey, in regular lines—an army on parade.

By 10 p. m. we heard distant barking, the canine concert which invariably preludes a Zapotec village, and that night we slept on the earthen floor of a windowless adobe house, our companions a cat and three turkeys. At 4 a. m. we rose and set forth again into the dark. Sunrise found us at the top of a low mountain pass. Before us stretched a wide valley still deep in purple shadow, and in the distance blue mountains with serrated crests bathed in pale golden light. This was the Valley of Ocotlán, a branch of the great Valley of Oaxaca, center of Zapotec civilization.

By 8:30 we reached the town, dominated by a domed church, salmon pink and pale jade green. In the market place, beneath striped awnings—some white, some terra cotta, like the sails of Venetian barges—all local produce is spread out. There is milk in plenty, coffee, chocolate, several kinds of bread, and dried fish brought up from the coast by mule and donkey. Oranges, bananas, and pineapples are piled in decorative heaps.

Even peanuts and beans, including special white beans, to be eaten on Fridays, are laid out in geometrical patterns, for the Mexican has an inborn sense of design, and nothing is too humble to be arranged with care and displayed as a work of art.

THE DRIVER EXPLAINED THAT HIS BUS HAD "DECOMPOSED"

Too many flour sacks caused the rear wheel to roll into a ditch somewhere between Oaxaca and Mitla. It is 25 miles between the two Mexican towns; the crippled vehicle made it in 14 hours. Three of the company procured donkeys and walked to Acapulco, 400 miles—and thereby hangs this tale (see text, page 757).

This innate artistic sense is specially evident in the hand- and home-made pottery (see opposite page). Almost every village retains its particular style in pottery, and towns such as Guadalajara* and Puebla have achieved a more than national reputation for their wares.

One of our party, suffering from headache, approached an herb stall. In a prominent position lay a red-crested woodpecker, which, as the chief cure for heart disease, is as obvious a professional sign to Indians as the barber's pole to us. Laid out on straw mats were starfish, sea shells, rattles from rattlesnakes, birds of brilliant plumage, and herbs to cure diseases both human and animal; but, curiously enough, for headache and heartache the cure was identical—two little patches of banana leaf affixed to the temples.

FEW VILLAGES ON THE TREELESS PLAIN

In the blazing noonday sun we set forth again across the treeless plain, its monotony relieved by giant candelabra cactus and many small artificial mounds, on one of which a man was actually sowing corn. Although this valley is still thickly populated, it is no center of civilization, as in the days when Mitla was built and pyramids or temples rose on nearly every hill. Though we trudged on all day and well into the night, we passed only one hamlet, San Pedro Apostol.

Typical of Zapotec villages were defiant walls of organ cactus lining the roadway and barricading every house—impenetrable barriers to all save the lean dogs who squeezed through to get a bark at our cavalcade. Characteristic, too, were the numerous pigs and turkeys, the former "dressed" in wooden triangles to prevent their prying into other people's business, and the latter resplendent with gorgeous blue throats and heads and dazzling white plumage. Turkeys are always to the fore in Mexico.

Our second night was passed at Ayoquezco, "The Place of Still Tortoises." Here we slept on the stone floor of a large earthquake-ruined hacienda along with 15 peons of both sexes, who, swathed in serapes and laid out in regular lines, resembled recumbent effigies of knights in an ancient church.

The following day we left the great Valley of Oaxaca, our trail keeping for a time to

* See "Vignettes of Guadalajara," by Frederick Simpich, in the NATIONAL GEOGRAPHIC MAGAZINE for March, 1934.

Drawn by Newman Bumstead

THE AUTHOR FOUND ANCIENT INDIAN CIVILIZATIONS ROOTED DEEP IN MEXICAN LIFE BETWEEN MITLA AND ACAPULCO

Photograph by M. Herbert

"PEGASUS" AND "PULLMAN" STOP BESIDE A CACTUS CANDELABRA

The blithely named donkeys proved to be neither fast nor freightworthy. Tall, cylindrical baskets peculiar to the Oaxaca region were strapped on their backs. Sunrise found the travelers in the Valley of Ocotlán, a branch of the Valley of Oaxaca, center of Zapotec civilization (see text, page 758).

STURDY TREES MAKE STOUT BOATS

Equipped with pole and paddle, the ferryman takes his boat across the Verde regardless of the season. With the nearest bridge 180 miles away, travelers have no choice but to accept transportation in these dugout craft, which, however, are amazingly seaworthy.

BOTH FISH AND FOWL LURE HIM

Large birds with loud cries like pneumatic road drills will be the target of the 70-year-old flintlock carried by this Negro-Indian hunter of the Verde River region. In shallow water he will kill fish with the machete hanging from his belt.

the Río Atoyac; but where this river bends round a mighty limestone bluff the path scales a mountain, then descends abruptly to Sola de Vega. In four hours we climbed this pass, famed for rattlesnakes and tarantula spiders. It was our first *subidita,* as the natives call any ascent, however large or small, so fearful are they of admitting the cold reality.

Beyond Sola neither an automobile nor even an oxcart can pass. The precipitous trail to Juquila ascends 2,800 feet, then drops nearly 7,700 feet, only to rise immediately another 8,000. These tremendous variations in altitude form a commercial, racial, and linguistic barrier, beyond which the level of civilization falls considerably. Sola is nominally Zapotec. The next town is Chatino.

This high "frontier" pass has typical changes of vegetation. First we climbed through shaded banana groves and fields of sugar cane; then to a zone of cultivated maguey; then, at 6,000 feet, to a more temperate zone, with oaks and other trees. Finally, perhaps a thousand feet higher, we entered a cool forest of long-leaf pine, the trees resplendent with white orchids, like candles on a Christmas tree, and gorgeous crimson flowers perched high in the upper branches.

LOST IN THE FOREST

Near the summit two men were driving a wild bull. With stout ropes the animal would be temporarily tethered to a tree. Then, once it was quiet, the ropes were uncoiled, and with one mad rush the men and their charge hurtled down the mountain. Some 50 yards farther on the ropes were coiled round another tree, instantly upsetting the bull, which kicked wildly in the air till, with ropes entangled in its legs, it lay helpless in the middle of the path.

Bull and men then recovered breath and the game continued, but this time the animal outdistanced its captors, dived into the forest, and finally lay bleeding and bellowing in a tangled skein of rope some 30 feet below the trail.

The sun was already sinking behind a distant peak when we reached the summit. Before us rose in gaunt majesty the Cerro de la Virgen, swathed in heavy gray clouds, and in the foreground lay a multitude of red-brown hills cushioned like a quilt.

Twilight fell; not a house nor a light could be seen; only a vast and gloomy forest—a blue-green carpet stretching to eternity. Darkness closed in, but still we continued down the mountain into the inky black night. Both donkeys were exhausted, and finally, after numerous falls, collapsed simultaneously.

We had lost our way, and it was foolish to explore the *barrancas* and stream beds at that hour. We simply lay down in the woods and slept. That day we had climbed up and down mountains for more than 12 hours, and had had little rest since accomplishing 30 miles in 13 hours on our first day.

All next day was occupied with the 7,700-foot descent to Juchatengo, and we camped again in the forest just above the Río Atoyac, only 150 feet above the sea. Halfway down, at Trapiche de Santa Ana, we found an oasis with shining banana groves and sugar cane, watered by the tiny Río de las Vueltas, which we forded 17 times.

With proper irrigation, this land could be a Paradise. Without the life-giving water, it remains a wilderness.

EARTHQUAKES ALMOST DAILY

The Atoyac, crossed at Ayoquezco as an insignificant stream and in Oaxaca as a chain of pools, is perhaps a hundred yards wide at Juchatengo. Having fallen 5,000 feet in less than 65 miles, the current is swift and dangerous.

Lying in a gigantic trough, with mountains rising to nearly 9,000 feet on either hand, this village, because of its low elevation and torrid climate, grows some of the best fruit in the State; but, because of difficulties of communication, the fruit sells for almost nothing. We bought 10 bananas, a pineapple, and a stick of sugar cane, all for about four cents; and delicious oranges, three for a third of a cent.

Juchatengo has the unenviable reputation of an earthquake almost every day. A few years ago, we were informed, the parish priest was murdered, and God has visited the town with quakes ever since.

The terrible earthquake which destroyed part of Oaxaca city on January 14, 1931, laid waste a district 150 miles long and 125 miles broad, a triangular area of about 9,500 square miles, and until we reached Jamiltepec scarcely a stone or adobe house stood intact.

Not only had buildings been overthrown by the shock, but whole mountain sides had slipped (landslides are still feared at Juchatengo, Juquila, and Miahuatlán), and rivers filled with earth overran their banks and destroyed the crops.

Even beyond Jamiltepec the towns of the Costa Chica (see text, page 783) are still desolate from previous earthquakes. In the State of Oaxaca alone more than 60 centers of seismic disturbance have been located. There are another 25 such centers in Guerrero, and at least 70 others near by, on the floor of the Pacific Ocean.

The 8,000-foot climb from Juchatengo to the Cerro de la Virgen took us nearly 15 hours, with two nights in the mountains—one near a deserted village with old silver mines and the other near the top of the pass. Clouds drenched us while we slept at the latter place. In these 35 miles only one inhabited village lies on the trail, Iolotepec, a name meaning "In the Heart of the Mountains."

Photograph by James Sturken

TWO PESOS A PIG

Fat sows are driven 130 miles overland, all the way from Juquila to Oaxaca. For the journey, which may take as long as three weeks, their tender feet are often wrapped in bandages or little shoes. The leg rope prevents escape.

Here scarcely a soul spoke Spanish, and our porter's Zapotec made the peasants laugh. It was our first village wholly Chatino, a tribe which, numbering about 12,000, extends through most of the Juquila district.

On the eighth day of our march we reached Juquila (119 miles from Oaxaca), where we "took up residence" in the patio

GIANT CACTUS THRUSTS A BLACK HAND THROUGH THE FOREST OF JAMILTEPEC

Little green parrots, beautiful turquoise butterflies, winged beetles, crimson dragonflies, humming birds, and magpies and golden calendar larks filled the air; scarab beetles, mud rollers, chameleons and lizards, iguanas and brilliant red ants crossed the paths; and the myriad crickets would sing in massed choirs like waves beating on the seashore, as the travelers passed through the twisted wood.

Photograph by James Sturken

SIESTA WAS INTERRUPTED BY AN EARTHQUAKE

While resting on the porch of a hut by the river bank at Juchatengo, the author received an unexpected shaking (see text, page 763). Even the donkey's extended ears seem to sense danger.

ONE MORE AND "PULLMAN'S" LEGS MAY FOLD UP

Loading the donkeys with their baggage baskets was drudgery for the three cross-Mexico hikers; and when the packs were in place, there began day-long anxiety that the beasts would collapse.

JAMILTEPEC'S ANCIENT CHURCH IS 150 MILES FROM ANY ROAD

Oxen drag a heavy log across a street undisturbed by wheeled traffic. Monumental sundials of Spanish architecture stand before the church, which is guarded all night lest unfriendly neighbors remove its miracle-working image. Such objects of religious veneration were found in many villages throughout the journey taken by the author and his two companions, but few were so elaborately housed.

A THOUSAND YARDS TO SWIM AND CROCODILES ALL AROUND!

Crossing the Verde, largest river in the State of Oaxaca, 14 miles from the sea, means peril for led animals; for the water is infested with vicious crocodiles, which may attain a length of 15 feet.

Photograph by James Sturken

AN OMETEPEC RESTAURANT TEMPTS MARKET TRADERS

Sweet delicacies cooked by Mixtecs from Tlaxiaco, straw hats fashioned by Triques from beyond Putla, beautiful trays, gourd vessels, and boxes of fragrant tropical woods made by Tlapanecos from the mountains of Guerrero and their neighbors from Olinolá—all are brought here for barter.

EACH BALANCES A BASKET OF BEANS

Mixtec women bring their produce to the Ometepec market for disposal. Their hand-woven smocks are richly decorated in crimson and blue. Although they retain a distinctive language, they express by a hand raised in disgust more than by a hundred words.

of an old ruined convent and left our donkeys in a field outside the village. A few years ago, and before the great earthquake, Juquila was an important town of perhaps 5,000 inhabitants, but now it is a mere hamlet, although it still derives an almost nation-wide fame from its tiny wooden image, which attracts throngs of pilgrims to its festivals.

To this image, only eight inches high, thousands of Indians make an annual pilgrimage on December 8. Most come from Oaxaca and little towns in the Mixteca Alta, or High Land of the Clouds, but some from more than two hundred miles away. We knew of one who had actually ridden from Ayutla, near Acapulco, 240 miles.

Those who come as a penance or because of a "promise" nearly always do so on foot, no matter what the distance, and for the last few miles some actually travel on their knees. Often they march in large groups, chanting as they go, carrying miniature shrines and forming torchlight processions as they wind up and down the hills by night.

Our trail from Sola is popularly known as the Road of the Virgin, and nearly every rock is associated with miracles. At the wayside shrines the Indians brush their aching limbs with flowers and beg the *virgen* to ease their pains. For ardent pilgrims she is said to make the road more laborious. Woe betide him who swears at the rocky, precipitous path; his portion shall be a broken ankle or leg, for this *virgen* prohibits swearing.

In the course of our stay two Government functionaries passed through Juquila, the Commissioner of Woods and Forests, and the Inspector of Licenses to sell alcoholic drinks. The dignity of the latter was enhanced by a giant Negro servant, who, arriving before his master, quickly discovered where alcohol was illegally sold. In due course fines were efficiently exacted.

Meanwhile the resentful populace took revenge on the Forest Commissioner by setting fire to a majestic pine on Government land in a vain attempt to set the forest ablaze.

If the first 120 miles of our journey were arduous because of the mountainous country traversed, the rest were difficult mainly because of the scarcity of food. The villages, few and very far between, could provide no luxuries, and for the next 17 days we lived almost exclusively on eggs, corn *tortillas*, bananas, and beans. Every day we each consumed ten or more eggs.

Bread was obtainable only in the larger towns, and even there was baked just once a week. Very rarely could we buy oranges or pineapples, but occasionally we had *panela*, a brown substance made from sugar cane and tasting like maple sugar. For drink we had coffee made with extract, and in the Hot Country coconut milk, sickly sweet, but a welcome change from the usually brackish water we drank from the streams.

Photograph by James Sturken

"HOW MUCH?"—"EH?"—"TOO MUCH!"

A tattered oldster haggles over the price of a Mexican water jar. Baskets and various pieces of pottery, for which his race is famous, clutter up the lanes of the market place. The old man's features are those reproduced countless times in ancient Zapotec grave figures.

DIFFICULTIES OF COMMISSARIAT

Since there were no village stores, procuring food entailed a house-to-house reconnaissance. From nearly every hut would come first a muttering in an unknown tongue, then the answer, "*No hay . . . No hay nada,*" "There isn't any." The Indian women seemed to delight in repeating with seraphic smile those dismal words, which were used so often that we came to classify the villages as *Hay* and *No Hay,* "There is" and "There isn't."

Toward the end of our trek, wearied by sleepless nights and long distances covered despite the torrid heat, we developed a craving for milk, seldom satisfied, since the Indians do not usually trouble to milk their cows. In large towns one can buy milk in the early morning, but we hardly ever reached a town before nightfall and usually left long before daybreak.

The country between Juquila (4,225 feet) and Tututepec (1,300 feet) is practically uninhabited. In the more than 50 miles between these towns we passed only two villages—Panixtlahuaca, the last in Chatino territory, and Santa Cruz, the first in Mixtec; and these lay 11 hours apart,

THE TUTUTEPEC WEATHER MAN IS A HEAVYWEIGHT

A granite idol six feet high, with twisted lips and large, almost round eyes, Tlaloc, the Rain God, wears ponderous earrings and necklace. The zigzag patterns of the hem of his robe are said to signify lightning, and the curious features just below his hands, falling drops of water (see page 776).

Photograph by James Sturken

HER ARMS ARE FULL; SO A BASKET IS HER HAT

A resourceful Mexican matron has stopped to buy meat on her way through the market on family business. The children have not been forgotten; in one of her baskets are three sticks of sugar cane. She is receiving her change in coins. Paper money means nothing in remote villages (page 757).

DONKEY AND MASTER SWIM THE SHIMMERING SANTA CATARINA

Near Ometepec the river unites with several streams tumbling down the mountains of the Mixteca Alta, or High Land of the Clouds, joins another below the village, and debouches into the Pacific through a lagoon famed for crocodiles. During the wet season it can rise to flood level and subside within four hours.

Photograph by James Sturken

MEXICAN TRADERS STOP TO GOSSIP UNDER PUBLIC SHELTERS

After carrying flour, fruit, and drink hundreds of miles to remote settlements, mule and donkey trains rest free of charge in resthouses like these seen in Panixtlahuaca and Santa Cruz. Every village in the district provides such thatch-roofed protection for travelers.

with no sign of life between, only lofty mountains and dense forests.

Panixtlahuaca, in its deep valley, more than 2,000 feet below Juquila, is an attractive and typical Chatino village. Water rushes everywhere. Bougainvillea, morning-glory, and convolvulus cluster in the trees. White turkeys strut up and down the cobbled lanes, and pigs run in and out of the houses, all of which are built of sticks and thatched with grass.

Inside the church some 20 Chatino women, kneeling on mats, recited the Ave Maria in high-pitched Indian tones. On their backs were fastened tiny babies swathed in scarves. One girl, stripped to the waist, beat herself with knotted rope, physical penance being common among these tribes. Indeed, it is not unusual to see both men and women walking in Good Friday procession with huge thorned cactuses tied to their backs and naked arms.

The church had no windows, no pews, no chairs, no organ, no priest; but 10 young men played lustily, though inharmoniously, a loud military march upon brass musical instruments and drums. When the din ceased, two nimble-fingered fiddlers struck up an Indian tune which was not unlike an Irish jig.

Later the band paraded the image of the local saint round the village. It was a wooden jointed image of Michael the Archangel, with waxen face, real clothes, glass eyes, and human hair. Finally the procession halted in front of the municipal building, the band continuing its efforts before the *Presidente* and three councilors, who sat cross-legged beneath the porch. Meanwhile, behind the church, six rockets and two small bombs were fired as a mark of appreciation.

They were a gay sight, these Chatino musicians, in their clean white "pajamas," crimson or imitation tiger-skin serapes, and immense sombreros. Their painted drum and flashing trumpets lent just that touch of modernity which appears in even the most remote corners of Mexico.

INDIAN CARRIERS AND TIME SENSE

For the next three days we clambered up and down the cushioned hills; rushing streams sated our thirst and made music in our ears. The few persons we met were

PINOTEPA WOMEN PREPARE FESTIVAL FOOD OF WHICH THEY EAT LITTLE

In a South Sea island setting cooks in brilliant blue homespun skirts, horizontally striped in red and yellow, grind maize and slap tortillas for a religious feast. Women may attend the celebration, but their portion of the viands is small (see text, page 782).

carriers, with mules or donkeys, transporting goods to and from the coast.

Among the characteristics of Indians thus encountered, most striking was their utter lack of time sense and their great physical endurance. With immense loads on their backs, they can walk 30 miles over mountains in a day, but never do they seem able to estimate time or distance.

When asked how far lay the next village, they would wave a hand at the sun and answer paradoxically, "It is now 3 o'clock; you will get there in two hours—about 7 this evening."

"Fairly distant" might imply anything from an hour's walk to a long day's march, and "Quite near" might entail a 10-mile tramp. With watches hidden, we tested their accuracy in reading sun time, often to find them out by several hours; and the number of leagues would sometimes *increase* as we neared the hoped-for village. In desperation we concluded that to an Indian a league is the distance he can walk in what he thinks is an hour, and an hour is the time in which he can walk what he thinks is a league.

Tututepec (172 miles from Oaxaca) is an old and famous name in Mixtec history. Here some 500 years ago, on the "Hill of Birds," reigned, in almost Arabic magnificence, the so-called "kings" or "counts" of Tututepec, latterly vassals of the Aztecs.

One of these princelings, even after the Spaniards captured Oaxaca, refused to acknowledge Spanish supremacy and made war on the natives of Tehuantepec down on the Isthmus. Hearing of this insurrection, Cortez's formidable lieutenant, Don Pedro de Alvarado, made in 1522 a punitive expedition to Tututepec, and the story of this raid almost parallels that of Cortez upon Mexico City.

The *cacique,* or "king," received the Spaniards well and lodged them in his own palace, a spacious and beautiful building; but Alvarado feared the Indians would set fire to their town and destroy the Spaniards and their horses in one terrible holocaust—an easy matter, since all houses save the palace were of wood and thatched with grass, just as they are to-day. He therefore made a camp of his own near by, and to it the king came daily with presents of gold

COAPINOLA COMMANDS A STRATEGIC POSITION

Between Ometepec and Acapulco, this Indian village is tucked between folds of the mountains of southwest Mexico. Indian natives warned of Negro bandits along the Pacific passes, and the travelers chose this highland route inland rather than the coastal path. The town is characteristic, steps of a terraced field climbing up to the shelf supporting a string of thatched huts.

NO "MIDDLE MAN" PROFITS ON HER CLOTHES

In her hand this Mixtec woman holds the raw material; on her back she wears the finished cotton product. All her garments are woven at home. She is skilled in needlework and an adept at the loom, upon which she can fashion cloth showing curious and intricate patterns that look as if they had been embroidered (see illustration, page 781).

"THE LITTLE BULL" FLAMES GAILY AT THE FEAST

After a day of mighty eating and drinking, the crowd at the Pinotepa religious celebration hails at night the setting off of this fireworks effigy of the *torito* (see text, page 782). As the Catherine wheels spin and set pieces explode, the bearer of the contraption dances a sort of Highland jig. If a fuse fails, the price must be repaid to the master of ceremonies.

SUCH DITCHLIKE ROADS BECOME RIVERS IN RAINY SEASONS

Traveling is a tedious business in this region of the State of Guerrero where there are neither railroads nor good highways. To traverse such mountains, one must follow endless zigzags which wind their tortuous way up and down the slopes.

and silver. Just as when Montezuma lavished gifts on Cortez and was rewarded with imprisonment and death, generosity was the downfall of the Mixtec king. The Spaniards grew avaricious, ordered more and more gold to be brought, and when the supply failed imprisoned the king, who died soon afterward.

PYRAMIDS AND IDOLS

Comparatively little remains of the town where these events took place, though Tututepec still retains several lofty mounds which appear artificial and might well be the bases of pyramids or the pedestals of temples. It is significant that on one of these stands the church, for the Spanish priests, wherever possible, set monuments of the new religion upon those of the old. A small stone goddess stands in front of the municipal building; near by sits a sphinxlike, headless animal; and beside the old ruined church, crowning the problematical pyramid, stands another far more imposing idol. A granite monolith six feet high, it represents Tlaloc, the Rain God (see illustration, page 770).

Archeologists, although relating Tlaloc to both Zapotec and Aztec sculpture, pronounce him Mixtec. He was originally an Aztec deity and is found in Zapotec and Mixtec territory only where Aztec influence had spread.

The whole region of Tututepec is teeming with unexplored relics of its former magnificence. Within three miles of the town lies another ancient city, the Pueblo Viejo.

One can see only vague traces of walls and a few small mounds, one of them terraced. The site is far smaller than that on Monte Albán,* and the mounds are not spaced with that consummate sense of town planning which distinguishes most ancient American cities.

Near by, between the Pueblo Viejo and the Río Verde, rises a hill, the Cerro de San Vicente, with a large cave containing rock-cut hieroglyphs and sculptured eagles. This cave is still held sacred by the natives, who make Holy Week pilgrimages to it. They believe it to contain the treasure of

* See "The Richest Archeological Find in America," by Dr. Alfonso Caso, in the NATIONAL GEOGRAPHIC MAGAZINE for October, 1932.

THE MACHETE IS AS HANDY AS A FARMER BOY'S JACKKNIFE

With his long, swordlike knife, the Mexican Indian harvests sugar cane, builds his home, kills fish, clears paths through tangled woods, cuts bananas, defends himself; in fact, there are few needs requiring a blade that it does not answer. Most of the sheathed weapons displayed for sale are manufactured in the United States or Germany.

CHILDREN OF RURAL DISTRICTS KNOW THEIR THREE R'S

In this new school of Yoloxochitl, a Mixtec village near San Luis Acatlán, a pure-blooded Indian lad of 12 knew the points of the compass, the biological peculiarities of the iguana, the population of his country, and the names of Aztec deities. The present Government has established excellent schools all over Mexico, many of them in remote districts (see text, page 788).

MAIL COMES BY BACK PACK AT 8- TO 10-DAY INTERVALS

Pinotepa, in the Costa Chica region of southwest Mexico, is 150 miles from the nearest railroad station, at Parian, and 210 miles from the nearest post road, at Tierra Colorada. Heavily laden postmen travel faster than horses or mules over the mountain passes of the Mixteca Alta (see text, page 768).

the Mixtec kings hidden before Alvarado's raid. The alleged gleam of buried gold is a feature of Indian as well as Negro lore.

Nearly every ancient Indian city of the hundreds in Mexico has its legend of hidden wealth or of royal tombs, and sometimes the natives let no white person approach. That there is truth in these stories is proved by finds like that at Monte Albán.

That the Indians know the value of archeological finds we quickly discovered. One we saw in Tututepec professed at first entire ignorance concerning jade, but afterward displayed a strange familiarity with the subject.

The origin of Mexican jade is an enigma as baffling as the deciphering of Mixtec, Zapotec, or Mixe hieroglyphs. Before the Spanish Conquest, axes, masks, tiny gods, amulets, badges of authority, talismans, earrings, necklace beads, funeral and priestly ornaments were fashioned in huge quantities from this hard-as-quartz material, than which not even gold was more highly prized.

In some ways it actually took the place of gold. It was eagerly accepted by the Aztecs as tribute from vassal sovereigns. Teeth of persons signally honored were "filled" with it.

Jade was traded throughout the length and breadth of the land and highly valued by nearly all the pre-Columbian civilizations from Mexico to Peru. The Spaniards, however, did not appreciate its beauty. Philip II wore a Mexican jade bead not for ornament but as a cure for kidney trouble. Jade carving has been a lost art on this continent for 400 years.

SOURCE OF MEXICAN JADE

Tradition asserts that jade was found in Mexico only in the Mixtec country and in Chiapas. Ancient tombs in the former district almost invariably contain jade objects; and it is highly significant that nearly all sculptured pieces discovered in Mexico—even those found in Querétaro, Vera Cruz, and Yucatán—bear definite signs of Mixtec

workmanship. However, no actual jade deposit, vein, quarry, or mine has ever been found here by white men.

The probable explanation of this is that no such mine or quarry ever existed. It is doubtful that there were gold or silver mines here before the Conquest; and, as with these precious metals, the famed green stone may have been simply picked out from the river beds.

There exist in fact carved jade pebbles with the marks of rippling streams still visible, but whence these pebbles came is again a mystery. It is said the streams of Teojomulco, near Sola de Vega, and other places in the Mixtec country, contain stones capable of a high polish. We found some near Tututepec similar to the ordinary stones often carved in place of jade.

Our Indian friend, by recalling an old tradition, threw new light on the subject. He said that jade cannot be distinguished from the outside, but is found only in the core or heart of the pebble. Later I discovered that in Burma jade is still obtained from the heart of pebbles and boulders, where the rich color and quality are found. The Indian tradition is thus substantiated.

It was at Tututepec that we entered the Tierra Caliente, or Hot Country, where the mountains sink into the coastal plain and the sea glistens on the horizon. For a hundred miles we traveled through dense tropical forest or thorny scrub—not a luxuriant forest like that on the Atlantic coast, where rainfall is heavier, but a maze of tangled undergrowth beneath occasional majestic trees. Through this virgin forest on the plain our path had carved a low, narrow tunnel into which the sun scarcely penetrated.

WILDERNESS TRAVEL BY NIGHT

The most nearly impenetrable forest lay between Tututepec and Jamiltepec, and much of this we traversed in the night, our route illumined by flaming pinewood torches. It was uncanny to see a troop of white-robed Indians hurrying down the mountains or threading the forest in the utter darkness of tropical night, each equipped with a blazing torch and long, unsheathed machete.

From their appearance these men would be judged a robber band; but though rough looking, with "penwiper" hair falling over eyes and faces that would scarcely grace Neanderthal man, they were friendly. We often joined them for safety.

Once, however, when we were suddenly surrounded in a thicket by a menacing-looking band of seven, we felt sure it was time to hand over our belts full of silver. We smiled sheepishly and expressed the wish that God would watch over them. Quietly they returned our salutation and asked if we had seen their wild bull. They were just cowboys! Of the real danger, the bull, we had been blissfully unaware!

We learned we need seldom fear Indians we actually saw. The Mexican brigand lies concealed, attacks from behind, and shoots before the victim is aware of his presence. Nevertheless, we seldom felt really secure until dawn broke and that ratchet-voiced bird, the chachalaca, had made the sunrise hideous with a call like the noise of a pneumatic road drill.

STRANGERS ARE NOT WANTED

Palm-encircled Jamiltepec, a day's march from Tututepec, is one of the most striking villages of the Mixteca Baja, or Low Country. It has a handsome white church and a spacious plaza with monumental sundials.

The local costumes are particularly attractive. Above a white cotton skirt, held by a blue cummerbund, the women wear a white shirt. This is thrown loosely over the shoulders and sometimes the head, so that the richly embroidered neckpiece forms a kind of headdress—very striking as well as practical in this sultry climate, and giving the effect of an oriental veil.

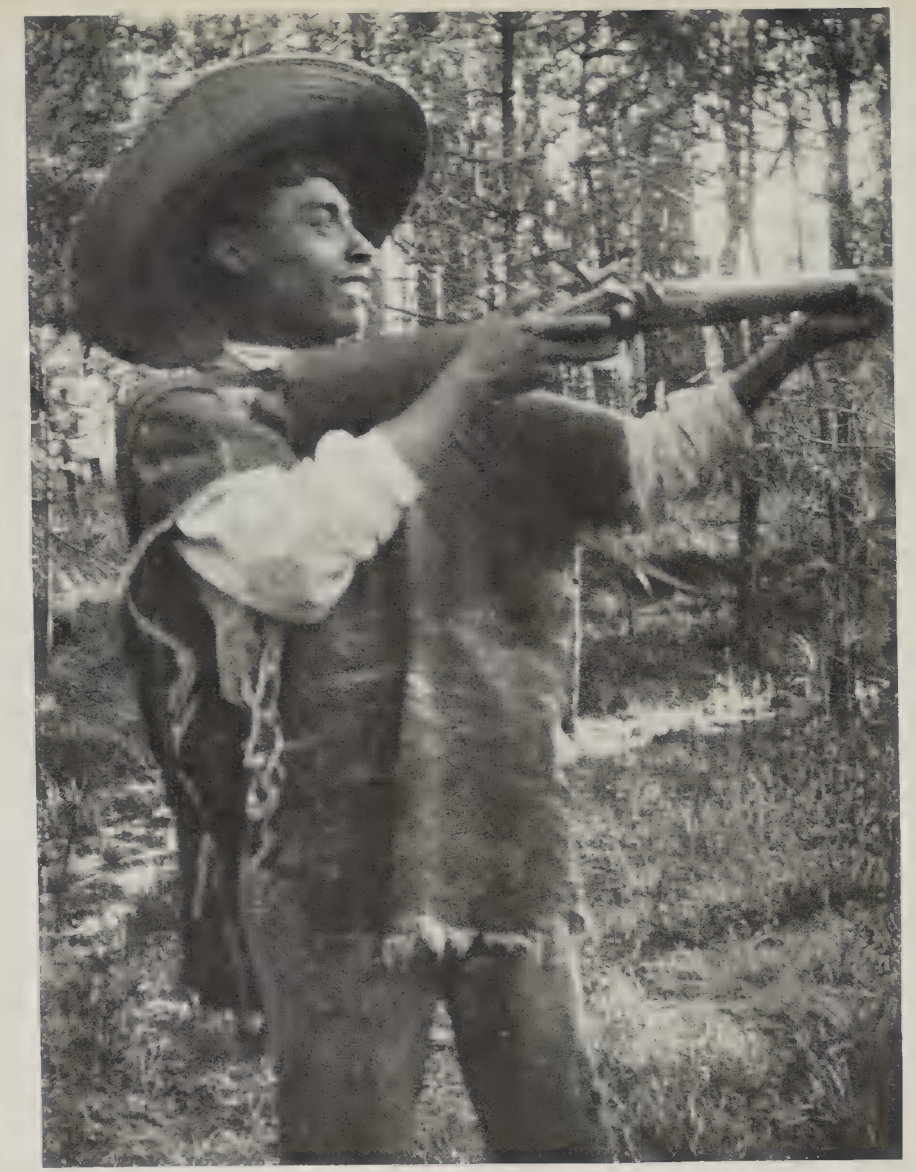
Immediately on arrival we heard the sound of rolling drums. The occasion was a religious feast, not, however, in a church, but in a small adobe house, where an Indian owned, as private property, an image of great local fame in curing skin diseases. Approaching, we found a large native gathering, but our presence caused such a stir that we surmised we were not wanted near the shrine. This suspicion became a certainty when, it being plainly obvious the fiesta was in full swing, we were told no fiesta would take place.

Almost throughout our trek Indians would inform us the next village was dangerous. On reaching it we were equally certain of congratulations on having passed the first village without mishap. As at Jamiltepec, the Indians were usually more afraid of us than we of them; but that the coastal region is none too peaceable is proved by the extraordinary number of wayside crosses set up, not as votive offerings, but as marks

Photograph by Albert T. Luscher

GALLEONS FROM MANILA ONCE TRADED SPICES FOR SHAWLS IN ACAPULCO HARBOR

Under the menacing guns of the ancient Fort of San Diego (right foreground), East met West to exchange merchandise. Legend tells of a Chinese princess, once sold into slavery here, who, on becoming a Christian, was beloved by all when she gave away her silks and jewels. The red skirt with a green border, white-embroidered blouse, and jauntily draped shawl that she wore became, with innovations, the local costume. The city offered soft beds and green vegetables to the foot-weary author and his two companions.



THE GUN DATES FROM 1861, BUT IT STILL SHOOTS

No modern repeating rifle, but an ancient muzzle-loader equipped with flint-lock, is this Chatino Indian's weapon for killing coyotes near Juquila, and his aim is deadly. How such firearms came into the country is not definitely known, but it seems probable that they were connected with some long-forgotten filibuster.

THE BELLE OF AMUSGOS PROVED SHY

She refused to be photographed alone and insisted that the girl in white stand with her. From the cotton her father had planted and her mother had spun she wove her pretty dress with its rich decoration. She did not embroider the pattern, but wrought it into the cloth on the loom by a difficult and painstaking art inherited from her ancestors.

ZACATEPECANS CLING TO TRADITIONAL COSTUMES

The cotton homespun garments of these three municipal councilors of the village are embroidered with figures representing birds and beasts. In the pouches of their trousers they carry provisions for long journeys, for Ometepec, the nearest town, is from two to three days distant.

for the sites of murders. I remember 12 such crosses in a stretch of five miles and 19 in another of 10 miles.

In Pinotepa Nacional, the next "large" town, we were able to watch a Mixtec festival without hindrance. A master of ceremonies (elected annually) has collected money to pay for the entertainment. For the actual feast no invitations are sent out, but all are welcome. If the year's contributions have been small, the male guests pay about 5 cents on arrival, after which they may eat and drink during the entire day and ensuing night. Ladies pay no subscription, but are allowed to eat only three tortillas (see illustration, page 773).

Early in the morning a long-drawn rolling of drums opens the feast, and the natives hasten to the majordomo's house, where, beneath a porch, sit musicians with harp, trumpet, fiddle, drums, and guitar made from armadillo shell. Before them men dance with *toritos* on their heads (see illustration, page 775), while round the yard the guests sit or stand clapping their hands in time to the music. The torito, apart from its slight resemblance to a bull, is an ingenious contraption—a bamboo framework to which rockets and fireworks of all kinds are fixed. It is set alight at night.

The journey from Pinotepa to Ometepec held in store for us a series of adventures attendant upon the crossing of a "frontier" far more important than those between In-

"WHAT NEWS ON THE RIALTO?"

The Mexican Indian's interest in the market place is keen. Here weaver and farmer exchange products, produce, and gossip of the village, while pigs scuttle about looking for morsels of food. Ayutla's white church holds high its clock that none may forget the hour of worship.

dian tribes. This part of Mexico, the Costa Chica (Little Coast), is occupied almost wholly by African Negroes.

They are descended from slaves imported by the Spaniards to cultivate sugar cane at Acapulco and Mazatlán. Most of their ancestors were brought from West Africa and from the Philippines (hence a few Negrito types survive) in the Manila galleons that called twice a year at Acapulco with cargoes of spices, silks, etc., to be sent across Mexico for transshipment to Europe.

For centuries the Negroes have dwelt and increased in numbers beside the Pacific, with the result that much of the coastal plain, at some points 30 miles wide, has become "a corner of Africa."

They speak no Indian or African language like that preserved in parts of Cuba and British Honduras, but rely on a peculiar dialect of Spanish.

Their small but very picturesque villages are composed either of round wattle huts patched with mud inside and out, or of huts walled and thatched with palm leaves. If the Mixtec festival at Pinotepa brought visions of the South Sea islands, the Negro villages near by recalled the Belgian Congo.

In temper and temperament we found the blacks very different from the Indians, usually sullen and discourteous. When we searched their villages for food, the invariable "There isn't any" would be reiterated with no seraphic and disarming smile, and

IT COST HIM SIX DOLLARS TO BUILD HIS HOME

No housing problem exists in San Luis Acatlán (see text, page 788). One family told the author that as soon as their son reached school age they would tear down their abode, pack it on a donkey's back, and move in "near town." Map makers find it difficult to keep up with villages that rise and disappear in two or three years. This dwelling has an open detached kitchen and sun porch.

we could well believe them to be the "bad people" with which the Indians stigmatize their name.

The Indians here cautioned us never to march at night, never to light a cigarette in open country after sunset, and never to sleep in a black village. No doubt their fears were greatly exaggerated. However, being unarmed, we heeded this latter warning, though it cost us several excessively long marches.

We covered the 60 miles to Ometepec, all of it through "black country," in two days. From Pinotepa we actually set out at 3 a. m., walked for 10 hours without a halt, and after a brief respite continued for another four hours.

A STRANGE FUNERAL

That night we reached a large village named Llano Grande, half Indian, half Negro, and despite doleful prophecies of robbery, we slept in a street porch. As it turned out, we were robbed, not by men, but by marauding dogs, which carried off all our provisions for the coming day.

Collecting food at 4 a. m. is a difficult task anywhere, and with deep misgivings I searched the village. From one hut strange music floated gently into the night. Peeping in, I saw four peasants, Negro-Indians, seated at a wooden bench—two with harps, one with a guitar, one with a drum. To a soft accompaniment they were singing a pretty little repetitive air of pre-Spanish type.

In the center of the hut, upon a table draped with hangings and with lighted candles at each corner, lay what seemed to be a small image. It was dressed entirely in blue and white paper and wore a crown painted gold and silver. At the back of the hut hung a white curtain with bunches of pink fruit blossoms.

Outside, several persons lay dozing, while an old woman stirred a caldron of boiling corn called *pozole*. "Is this a funeral? Who is dead?" I asked cautiously. One of the harp players pointed to the "image" on the table. "This little angel," he replied softly. Only then did I realize that the figure dressed in colored paper was a baby.

POTTERY SERVES MANY PURPOSES

The utensil the man holds is for cooking; the deep-bowled vessels are water jars. Most Negroes of the Costa Chica region (see page 783) do little work. Bananas, coconuts, and iguanas are their chief food, though shallow-stream fish are killed with machetes.

Photograph by James Sturken

STRIKING BLANKETS BRIGHTENED THE SQUALOR OF AYUTLA

Serapes, baskets, and sombreros immediately identify the Mexican locale. Outside the open door a bird cage rests on the arm of a wooden cross.

THE REPTILES CLIMBING THE TREE ARE STUFFED

Turtles, alligators, and iguanas lure the passer-by in many of Mexico's west-coast cities. Here they provide ornamentation for the fish dealer's stand, which is laden with parrotfish, sunfish, sea leeches, and horseshoe crabs. Lumps of coral and a variety of shells are on the table.

"It died from a fever of 'black cough,'" explained the old woman, handing me a gourd bowl of pozole and a cup of chocolate. I accepted the former, but not the latter; for only the day before we had been informed of a strange custom, idyllic in concept, but barbarous in practice and only one step removed from cannibalism.

Happily this terrible practice is confined to the Negro and Negro-Indian region, but all through Mexico the Indian child is dressed, as here, to resemble the Virgin, and lies in state through the night, while musicians play to it and sing little verses. Official mourners, replaced every few hours, are elected to watch the dead while a cook is hired to distribute food.

In the black villages health conditions are worse than elsewhere, though many of the neighboring Indians suffer from *pinto,* or "Mexican leprosy," which covers the hands with white spots and the face with black or dark-blue blotches. Normally not contagious, it often passes from parents to children, but does not seem to affect the sufferer's energy, mental or physical. There are villages where every one is thus afflicted.

As "people with reason" (the popular and pathetic Indian name for all white persons), we were often asked to prescribe remedies for dysentery and malaria, since native cures are extremely crude and these maladies work havoc on the Costa Chica. We heard that sea shells, ground to powder and mixed with linseed oil, should be applied to smallpox sores; that coral, ground and drunk in wine, cures heart attacks, and that armadillo shell, boiled in water and taken at night, is instant cure for a cold.

A Negress told us sorrowfully she had visited the shrines of both Juquila and Huaxpaltepec and *still* her baby had spots. She was now covering them with green slime from the Santa Catarina River, but hailed with delight our more orthodox application of an antiseptic because of its gorgeous color. Doctors seem scarce and the natives prefer to rely on miraculous cures from local saints or on herbalists who deal also in magic. They had suffered much from renegade whites.

On our 17th day of actual traveling we reached the State of Guerrero and Ometepec, a comparatively large town, bright

MONSTERS OF THE LAGOONS REACH JOURNEY'S END

Scale-backed, ugly-jawed crocodiles, some of them 12 feet long, are captured and killed in the shallow channels near Acapulco. Some are caught by means of coconuts thrown on the ends of ropes. Once the bait is in their jaws, the reptiles can neither swallow it nor let go.

and cheerful, with its clean streets and two-storied buildings—the first we had seen since leaving Oaxaca.

Ometepec is chiefly interesting as the trading place of many Indian tribes (see illustrations, pages 767, 768). The painted designs on trays, gourd vessels, and wooden boxes offered for sale suggest that the Indians have never forgotten the taste for chinoiseries imported by the Spaniards nearly 200 years ago. Their special lacquer finish is so hard—it is the work of weeks of polishing by hand—that some Americans recently traveled to Olinolá to learn the secret process, hoping to apply it to automobile painting.

Many of these tribes retain their distinctive dress, that of the Mixtecs of Zacatepec being the most curious (782), and all have retained their distinctive languages.

AMUSGO SOUNDS LIKE CHINESE

The Aztecs overran this territory shortly before the Spanish Conquest and are still represented near Ometepec by two small villages speaking Aztec, or Mexicano. For a language thus to survive some 500 years in complete isolation is convincing proof of Indian conservatism. But far older and most astonishing of all the linguistic survivals in this region is the language of Amusgo, spoken in six villages in Guerrero and three in Oaxaca, but nowhere else.

Unlike the Mixtec spoken all around, it has few agglutinative words, most being of only two syllables, with many labials and nasal sounds almost impossible to render in Latin characters. Nearly every word begins with a consonant and ends with a vowel, and the precise pitch or accent of this vowel determines the meaning.

To the uninitiated this extraordinary tongue sounds exactly like Chinese. Those few Amusgos who can talk Spanish speak it with what might easily pass for a Chinese accent, both as to the vowel sounds and even to the substitution of L's for R's. The latter consonant does not exist in Amusgo.

It would be foolish to guess at the history of this minute tribe—at the most 2,000 persons. Perhaps it is the last remnant of a civilization far older than the Mixtec. On the other hand, the language may be equally well descended from a dialect of Mixtec

or Zapotec or Chatino, or from the parent of these.

Although this "island" tribe is an archaism and its history a riddle, there is present the inevitable anachronism or paradox. At Amusgos village, where centuries of Spanish rule have failed to implant the Spanish language or to replace the ancient native costumes (see page 781), basketball is played with enthusiasm and children whistle modern dance tunes from Mexico City.

From Ometepec two roads lead to Acapulco. We had no wish to test the accuracy of stories about the dangers of the one along the coast, and for another eight days we toiled over the mountain-forest trail, glad to be again with Indians. However, the Indians hereabouts were not so friendly as we had anticipated. We arrived at a village named Azoyo just in time to witness the funeral of a schoolmaster murdered the night before. We beat a hasty if undignified retreat.

The Indians of another village, San Luis Acatlán, told us their neighbors of Azoyo were bad people, and that there was constant "warfare" between the villages, interrupted only on important saints' days, when both peoples visited the same shrine.

Don Pedro, head of the family which befriended us here, was justly proud of his newly built house, which had cost him less than six dollars (see illustration, page 784). The speed with which such houses of sticks, mud, and grass are erected renders the rural population of Mexico almost nomadic.

In the matter of education, Don Pedro's 12-year-old son was something of a prodigy. Bitterly he complained that the Government had not dispatched protractors for his studies in geometry!

GOOD SCHOOLS IN REMOTE VILLAGES

Throughout our trek in the most remote districts we were amazed by the number and excellence of schools which the present Government has planted all over the country—amazed, too, by the Indian children's bright mentality and their eagerness to learn. These schools, built not with State or Federal money, but by the little communities, all able-bodied men coöperating freely, are the just pride of the Nation.

But, since these schools have existed a very short time, one often finds them in strangely close juxtaposition with ancient customs still observed by the older generation. At Concordia, between San Luis Acatlán and Ayutla, there come for the Feast of the Virgin, on July 16, veritable hordes of primitive Mixtecs, who to this day sacrifice turkeys at the foot of an iron cross beside the church.

On the death last year of a cacique in this same village, the chief's favorite horse carried his hat and spurs in the funeral procession; the cacique was buried in full *charro* costume; chickens were slaughtered, and food, drink, and money were deposited in the grave.

MIXTEC FOR "FEAR" MEANS "AUTO"!

Though education is rapidly killing such interesting survivals as well as the pre-Cortez languages, Mixtec is still preferred by the grown-ups, and curiously enough it keeps pace with innovations. There are now genuine local Mixtec words for buttons, sewing machines, and even automobiles, the last named being appropriately associated with the word *fear!*

The last town of any size before Acapulco is Ayutla, a thriving little place of 3,000 souls, with an active market, situated in a wide valley, with the sea visible 15 miles away. Unfortunately, Ayutla was not for us the Paradise it looked. Every kind of noxious vermin seemed to flourish in this place. Winged cockroaches more than three inches long buzzed around our candle, and when all was quiet scorpions dropped from the rafters over our heads.

Our last 75 to 80 miles—Ayutla to Acapulco—we traveled once more on the coastal plain, part Indian, part Negro, with one or two villages famed for their charmingly polite inhabitants, who with gun held nonchalantly in the hand "beg for the loan" of five or ten pesos.

Cortez's first glimpse of the Pacific could not have been more enthralling to him than to us our first view of Acapulco, lying serenely in its sheltered bay. In 25 days of actual marching we had covered more than 400 miles. We had slept seven nights in the forest, seven nights on the earthen floors of Indian villages, six nights beneath wooden porches on village streets, and one night in the middle of the road. To us, more appealing than its natural beauties were the hot baths, real beds, fresh milk, and green vegetables of Acapulco.